











THE  
NEW GRESHAM  
ENCYCLOPEDIA  
VOLUME IV

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# THE NEW·GRESHAM ENCYCLOPEDIA

VOLUME IV



THE·GRESHAM·PUBLISHING  
COMPANY·LIMITED  
LONDON

*Printed in Great Britain 1923*

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# KEY TO PRONUNCIATION

The method of marking pronunciations here employed is either (1) by marking the syllable on which the accent falls, or (2) by a simple system of transliteration, to which the following is the Key:—

## VOWELS

- |   |   |
|---|---|
| ā, as in <i>fate</i> , or in <i>bare</i> .  | eu, a long sound as in Fr. <i>jeûne</i> =Ger. long <i>ö</i> , as in <i>Söhne</i> , <i>Göthe</i> (Goethe).       |
| ä, as in <i>alma</i> , Fr. <i>âme</i> , Ger. <i>Bahn</i> =ä of Indian names.  | eu, corresponding sound short or medium, as in Fr. <i>peu</i> =Ger. <i>ö</i> short.                             |
| à, the same sound short or medium, as in Fr. <i>bal</i> , Ger. <i>Mann</i> .  | ō, as in <i>note</i> , <i>moan</i> .  |
| a, as in <i>fat</i> .   | o, as in <i>not</i> , <i>soft</i> —that is, short or medium.  |
| â, as in <i>fall</i> .  | ō, as in <i>move</i> , <i>two</i> .   |
| ɑ, obscure, as in <i>rural</i> , similar to <i>u</i> in <i>but</i> , <i>ê</i> in <i>her</i> : common in Indian names. | û, as in <i>tube</i> .  |
| ē, as in <i>me</i> = <i>i</i> in <i>machine</i> .   | u, as in <i>tub</i> : similar to <i>ê</i> and also to <i>a</i> .  |
| e, as in <i>met</i> .   | û, as in <i>bull</i> .  |
| è, as in <i>her</i> .   | ü, as in Sc. <i>abune</i> =Fr. <i>û</i> as in <i>dû</i> , Ger. <i>ü</i> long as in <i>grün</i> , <i>Bühne</i> . |
| ī, as in <i>pine</i> , or as <i>ei</i> in Ger. <i>mein</i> .  | û, the corresponding short or medium sound, as in Fr. <i>but</i> , Ger. <i>Müller</i> .                         |
| i, as in <i>pin</i> , also used for the short sound corresponding to <i>ē</i> , as in French and Italian words.       | oi, as in <i>oil</i> .  |
|   | ou, as in <i>pound</i> ; or as <i>au</i> in Ger. <i>Haus</i> .  |

## CONSONANTS

Of the *consonants*, *b*, *d*, *f*, *h*, *j*, *k*, *l*, *m*, *n*, *ng*, *p*, *sh*, *t*, *v*, *z*, always have their common English sounds, when used to transliterate foreign words. The letter *c* is not used by itself in re-writing for pronunciation, *s* or *k* being used instead. The only consonantal symbols, therefore, that require explanation are the following:—

- |  |   |
|--|---|
| ch is always as in <i>rich</i> .   | s, always as in <i>so</i> .   |
| d, nearly as <i>th</i> in <i>this</i> =Sp. <i>d</i> in <i>Madrid</i> , &c.   | th, as <i>th</i> in <i>thin</i> .   |
| g is always hard, as in <i>go</i> .  | th, as <i>th</i> in <i>this</i> .   |
| h represents the guttural in Scotch <i>loch</i> , Ger. <i>nach</i> , also other similar gutturals.                 | w always consonantal, as in <i>we</i> .   |
| ñ, Fr. nasal <i>n</i> as in <i>bon</i> .   | x=ks, which are used instead.   |
| r represents both English <i>r</i> , and <i>r</i> in foreign words, which is generally much more strongly trilled. | y always consonantal, as in <i>yea</i> (Fr. <i>ligne</i> would be re-written <i>lëny</i> ). |
|  | zh, as <i>s</i> in <i>pleasure</i> =Fr. <i>j</i> .  |

# THE NEW GRESHAM ENCYCLOPEDIA

## VOLUME IV

•**Deposition of a Clergyman**, the degradation of a clergyman from office, divesting him (in churches which do not, like the Church of Rome, hold the indelible nature of orders) of all clerical character.

**Dépôt** (dā'pō or dep'ō), a French word in general use as a term for a place where goods are received and stored; hence, in military matters, a magazine where arms and ammunition are kept. The term is now usually applied to a military station situated in the centre of the recruiting district of a regiment, where recruits for this regiment are received and where they undergo preliminary training before joining their unit. In America it is the common term for a railway station.

**Deprivation**, the removing of a clergyman from his benefice on account of heresy or misconduct. It entails, of course, loss of all emoluments, but not the loss of clerical character.

**De Profundis**, in the liturgy of the Roman Catholic Church, one of the seven penitential psalms, the 130th of the *Psalms* of David, which in the *Vulgate* begins with these words, signifying 'Out of the depths'. It is sung when the bodies of the dead are committed to the grave.

**Deptford** (det'ford), a parliamentary and municipal borough, England, in the counties of Kent and Surrey, on the right bank of the Thames, now forming part of London. It has some manufactures of pottery, chemicals, and soap. The old naval dockyard was shut up in 1860, but the royal victualling yard is still the largest establishment of its kind. Deptford sends one member to Parliament. Pop. 100,406.

**Deputies, Chamber of**, the lower of the two legislative chambers in France and in Italy, elected by popular suffrage, and corresponding in some respects to the House of Commons in Britain.

**De Quincey**, Thomas, English author, was the son of a Manchester merchant, and born at Greenheys, near Manchester, on 15th Aug., 1785, died at Edinburgh, 8th Dec., 1859. In 1798 his

father died, leaving the family a fortune of £30,000. After attending some time the Bath and Manchester grammar schools, where he showed precocious ability, especially in classical studies, he importuned his guardian to send him to Oxford University, and on being refused he ran away from school, ultimately arriving in London in an absolutely destitute condition. His sufferings at this time he has described in his *Confessions of an English Opium Eater*. At length, in 1803, he matriculated at Oxford, and it was in the second year of his course here that he began to take opium in order to alleviate severe neuralgic pains. On leaving college he settled at Grasmere, Westmoreland, in the vicinity of Wordsworth and Southey, and devoted himself to literary work. Here or in London he remained till 1828, reading voraciously, and writing for the *London Magazine*, *Knight's Quarterly Magazine*, and *Blackwood's Magazine*. From 1828 to 1840 he lived in Edinburgh, then removed with his family to Lasswade, which continued to be his head-quarters. His writings, nearly all contributions to magazines, are distinguished by power of expression, subtle thought, and an encyclopædic abundance of curious information. His work belongs to that class of literature which he himself called "the literature of power", as distinguished from "the literature of knowledge". He was eccentric in his habits, incapable of managing money matters, but amiable and polite.—**BIBLIOGRAPHY:** A. H. Japp, *Thomas De Quincey: his Life and Writings*; H. S. Salt, *De Quincey*; J. Hogg, *De Quincey and His Friends*; Sir L. Stephen, *Hours in a Library*; Arvède Barine, *Poètes et Névrosés*.

**Dera Ghazi Khan**, a district and town in the Punjab, Hindustan. The former, which is in Derajat division, has an area of 5606 sq. miles, and a population of 445,000. The town has a population of 18,400, half Hindus and half Mohammedans. It has extensive manufactures of silk, cotton, and coarse cutlery.

**Dera Isma'il Khan**, a town in Baluchistan, in the North-West Frontier Province, several miles to the west of the Indus, which is here crossed by boat-bridges, or boats, connecting the town with the Indus Valley railway. Dera Isma'il Khan is a staple place for cotton goods, has a cantonment, and carries on a trade with Afghanistan. It is well laid out, has several schools and a large bazaar. Pop. 35,131.

**Derajat** (-jāt'), a commissionership of Hindustan, in the west of the Punjab, occupying part of the valley of the Indus. It is well watered and fertile, and contains numerous towns and villages. Pop. 1,800,000, mostly Mahomedans.

**Derbend'**, or **Derbent'**, a fortified town in Daghestan, Transcaucasia, on the west shore of the Caspian, an ancient place formerly belonging to Persia. The manufactures consist of woollen stuffs, copper- and iron-ware, and rose-water; and there is some trade in saffron, largely grown in the vicinity. Pop. 32,718.

**Derby**, Edward Geoffrey Smith Stanley, fourteenth Earl of, an English statesman, born at Knowsley Park, Lancashire, 29th March, 1799, died there, 23rd Oct., 1869. In 1820 he was returned to the House of Commons as member for Stockbridge. At first inclining to the Whig party, he joined Canning's ministry in 1827, and in 1830 became Chief Secretary for Ireland in Lord Grey's Government, greatly distinguishing himself by his speeches in favour of the Reform Bill in 1831-2. The opposition led by O'Connell in the House of Commons was powerful and violent, but Stanley, while supporting a Bill for the reform of the Irish Church and the reduction of ecclesiastical taxation, was successful in totally defeating the agitation for the repeal of the Union. He warmly advocated the abolition of slavery, and passed the Act for this purpose in 1833; but in the following year a difference of opinion with his party as to the diversion of the surplus revenue of the Irish Church led him to join the Tories. In 1841 he became Colonial Secretary under Sir Robert Peel, but resigned on Peel's motion for repeal of the corn laws. In 1851 and 1858 he formed ministries which held office only for a short period; and again in 1868, when his administration signalized itself by the reform of the government in India, the conduct of the Abyssinian War, and the passing of a Bill for electoral reform (1867). Early in 1868, owing to failing health, he resigned office, recommending Disraeli as his successor. Lord Derby joined to great ability as a statesman, and brilliant oratorical powers, a high degree of scholarly culture and literary ability. Among other works he published a successful translation of Homer's *Iliad* in 1864.—Cf. T. E. Kebbel, *English Statesmen Since the Peace of 1815: Derby*.

**Derby**, Edward George Villiers Stanley, seventeenth Earl of, British politician, born in April, 1865. He served for some years in the Grenadier Guards, and entered the House of Commons in 1892. In 1895 he became a Lord of the Treasury, in 1900 Financial Secretary to the War Office, and in 1903 Postmaster-General. He succeeded to the earldom in 1908. Lord Derby became quite famous as the originator of the *Derby Scheme*, when he was Director-General of Recruiting in 1915. Under-Secretary for War in 1910, he succeeded Lloyd George as Secretary when the latter became Premier. In 1918 he was appointed British Ambassador in Paris, but resigned his position in Sept., 1920, and left Paris in Nov., greatly to the regret of the French people, to whom he had proved a staunch friend.

**Derby**, a municipal, parliamentary, and county borough in England, capital of Derbyshire, on the Derwent, here crossed by a graceful bridge of three arches, 115 miles N.N.W. of London. It is pleasantly situated in a wide and fertile valley open to the south, and is well and regularly built in the modern quarter. It has some fine public buildings, amongst which are the churches of All Saints, St. Alkmund, and St. Werburgh, the county hall, school of arts, and infirmary. There is also a very handsome free library and museum. The manufactures include silk, cotton, hosiery, lace, articles in Derbyshire spar, iron castings, and porcelain; and the principal engineering works of the Midland Railway are here. Derby is one of the oldest towns in the kingdom, and is supposed to owe its origin to a Roman station, Derventio. Under the Danes it took the name of Deoraby. Richardson, the novelist, and Herbert Spencer were natives. It returns two members to Parliament. Pop. 123,930 (1919).—The county of *Derby*, in the centre of the kingdom, is about 55 miles long and from 15 to 30 miles broad; area, 650,309 acres, five-sixths being arable or in permanent pasture. It exhibits much varied and romantic scenery, the southern and eastern parts having a fertile soil, while the north-western portion is bleak, with a rocky and irregular surface. Here is the loftiest range of the English Midlands, the mountains of the Peak. The Peak itself is 2000 feet high. The principal rivers are the Derwent, the Trent, the Wye, the Erwash, the Dove, and the Rother. Oats and turnips are important crops, and dairy-husbandry is carried on to a large extent. Coal is abundant in various parts of the county, iron-ore is also plentiful, and lead, gypsum, zinc, fluor-spar, and other minerals are obtained. The manufactures are very considerable, especially of silk, cotton, and lace, machinery, and agricultural implements. The county is divided into

## DERBY-DAY

eight parliamentary divisions, each with one member. Pop. 683,423.—Cf. J. C. Cox, *Derbyshire*.

Derby-day, the great annual London holiday, on which is run the horse-race for the stakes instituted by Lord Derby in 1780. It always takes place on a Wednesday, being the second day of the grand race-meeting which falls in the week after Trinity Sunday. The race is run on Epsom Downs, an extensive Surrey course 15 miles from London. The course is  $1\frac{1}{2}$  miles, and the time usually about 2 minutes, 42 seconds. The entry money of each subscriber is fifty guineas, and the stakes are run for by three-year-old colts and fillies entered within yearlings. In the first year of the Derby there were only thirty-six entries, but they are now very numerous, and the value of the winner's prize is at least £5000. The race is the most popular of British sporting events. The Ascot races are patronized by royalty; the world of fashion is to be found at Goodwood; but Derby-day draws to Epsom a vast crowd of every class. During the European War the race was suspended, but a substitute Derby was run at Newmarket from 1915 to 1918. In 1919 the Derby was again run at Epsom, and was won by Lord Glanely's *Grand Parade*. In 1920 it was won by Loder's *Spion Kop*, and in 1921 by Joel's *Humorist*.

Derby Scheme, a scheme produced by Lord Derby in 1915 with a view to making a final effort on behalf of voluntary recruiting. The National Register (q.v.), taken in August, 1915, of all persons between the ages of fifteen and sixty-five, had shown that over five million men of military age had not 'joined up'. As the number of recruits each week fell short of the number required by Lord Kitchener, Lord Derby, appointed Director of Recruiting, produced a scheme in which men were divided into 46 groups. Groups 1 to 23 were for single men, and groups 24 to 46 for married men. Thus a married man of eighteen was in group 24, whilst a single man of forty-one was in group 23. The scheme ensured that single men would be called up first, whilst men who had 'attested' could appeal to a tribunal and claim temporary or permanent exemption. Two and a half millions offered themselves in consequence of the Derby Scheme, and two millions were accepted.

Dereham (dēr'am), East, a town in England, nearly in the centre of the county of Norfolk, with manufactures of agricultural implements, iron-foundries, and a brisk trade. The poet Cowper was buried in the church there, and George Borrow was born there in 1803. Pop. 5524.

Der-elict, a vessel or anything relinquished or abandoned at sea, but most commonly applied to a ship abandoned by the crew and left floating about.

Derg, Lough, a lake in Donegal, and county of Donegal, about 3 miles long by  $2\frac{1}{2}$  miles broad at the broadest part, and studded with islets, one of which, called Station Island, is a great resort of Roman Catholic pilgrims; (2) an expansion of the River Shannon between County Tipperary and Counties Clare and Galway, about 24 miles long and averaging 2 miles in breadth.

Derham, William, English philosopher and divine, born in 1657, died 1735. He was long rector of Upminster in Essex. In 1696 he published his *Artificial Clockmaker*. His best-known works are entitled *Physico-Theology*, *Astro-Theology*, and *Christo-Theology*.

Derma, or Dermal, is the true skin lying under the epidermis (cuticle), which is known in contrast as the scarf-skin.

Dermestes, a genus of beetles, one species of which (*D. lardarius*) is known by the name of 'bacon-beetle', and is often found in ill-kept ham or pork shops.

Dermot Mac Murragh, the last Irish King of Leinster, attained the throne in 1140. Having carried off the wife of O'Ruare, Prince of Leitrini, he was attacked by the latter, and after a contest of some years driven out of Ireland (1167). He then did homage to the English king, and with the help of Richard, Earl of Pembroke, recovered his kingdom, but died in the same year (1170), and was succeeded by Pembroke, who had married his daughter.

Dernburg, Bernhard, German financier and administrator, born in Darmstadt in 1865. His father was an editor of the *Berliner Tageblatt*. At the age of nineteen he came to New York to study banking methods, stayed there for several years, and on his return to Germany became director of a financial company. In 1906 he succeeded Prince von Hohenlohe Langenburg as Colonial Secretary. During his administration the condition of German colonies, and especially of German East Africa, was greatly improved. From 1914 to 1915 he was a zealous organizer of German propaganda in the United States, but was subsequently compelled to leave the country.

Déroulède, Paul, French poet, politician; and agitator, born in Paris in 1846, died there in 1914. Called to the Bar in 1870, he served in the Franco-Prussian War, and afterwards carried on an active and passionate agitation for a war of revenge against Germany. He founded the *Ligue des Patriotes*, which was suppressed by the Government in 1889, was an ardent supporter of General Boulanger, and one of the leaders of the reactionary forces during the Dreyfus case. He sat in the Chamber of Deputies from 1893 to 1895 and from 1898 to 1899. In 1900 he plotted against the Republic, and sought to bring about a nationalist *coup d'état* with a view to overthrowing the parliamentary constitution. Found

guilty, he was exiled, but was allowed to return in 1800, under the law of amnesty. His works include: *Chants de Soldat* (1872); *Nouveaux Chants de Soldat* (1875); *Chants du paysan* (1894); *Poésies Militaires* (1896); *La Moëbite*, a religious drama (1880), forbidden by the Censor; and *L'Iletman*, a patriotic play (1877).

**Derrick**, a simple kind of crane, chiefly used on board ship, consisting of a stout pole swung from a mast, and carrying hoisting-tackle at its upper end. The name is derived from that of a celebrated hangman.

**Derringer**, a small pocket pistol with a short barrel and a large calibre (usually .41), very effective at short range. It is named after its inventor, a gun-smith in the United States of America, and would seem to have been first used in about 1850. It is a single-shot weapon, and so has largely been superseded by revolvers and automatic pistols.

**Der'vish**, or **Dervise** (Pers., 'seeking doors' or beggar, and equivalent to the Ar. *fakir*), a Mohammedan devotee, distinguished by austerity of life and the observance of strict forms. There are many different orders of dervishes, the underlying idea of most of them being the revival and increase of the Moslem faith. Some live in monasteries, others lead an itinerant life, others devote themselves to menial or arduous occupations. They are respected by the common people, and the mendicants among them carry a wooden bowl into which the pious cast alms. One of their forms of devotion is dancing or whirling about, another is shouting or howling, uttering the name *Allah*, accompanied by violent motions of the body, till they work themselves into a frenzy and sometimes fall down foaming at the mouth. They are credited with miraculous powers, and are consulted for the interpretation of dreams and the cure of diseases. See *Mohammedanism*.—BIBLIOGRAPHY: E. W. Lane, *Modern Egyptians*; J. P. Brown, *The Dervishes, or Oriental Spiritualism*; S. M. Zwemer, *Arabia, the Cradle of Islam*.

**Der'went**, the name of four rivers in England, in Derbyshire, Yorkshire, Durham, and Cumberland respectively, the last draining Derwentwater Lake. Also a river in Tasmania.

**Derwentwater**, James Radcliffe, third and last Earl of, one of the leaders in the rebellion of 1715, born in London 28th June, 1689. The standard of revolt having been raised in Scotland, Lord Derwentwater commenced the movement in England on 6th Oct., 1715, but was forced, along with the other Jacobite nobles, to surrender at discretion on 18th of Nov. He was executed on Tower Hill 24th Feb., 1716, his estates being confiscated, and in 1735 granted to Greenwich Hospital.

**Der'wentwater**, or **Keswick Lake**, a beautiful lake in Cumberland, England, in the vale of Keswick. It is about 3 miles in length and 1½ miles in breadth, and stretches from Skiddaw on the north to the hills of Borrowdale. Near the south-east corner is the celebrated cascade of Lodore. Its waters are carried to the sea by the Derwent.

**Derzhavin** (der-zhā'vin), Gabriel Romanovitch, a Russian lyric poet, born in 1748, died in 1816. He entered the army as a private soldier, distinguished himself highly, and was eventually transferred to the Civil Service, in which he obtained the highest offices. In 1803 he retired from public life and devoted himself entirely to poetry. One of his most beautiful poems is *Oda Bog*, or *The Address to the Deity*.

**Desaguadero** (des-ā-gwā-dā'rō), a river of Bolivia, in a valley of the same name, issuing from Lake Titicaca, and carrying its waters into Lake Aullagas. Also a river in the Argentine Confederation flowing into Lake Beverero Grande, and separating the provinces of San Juan and Mendoza. Desaguadero signifies in Spanish 'a channel of outlet'.

**Desaix de Veygoux** (dē-sā dē vā-gō), Louis Charles Antoine, a distinguished French general, born in 1768 at St. Hilaire d'Ayat, in Auvergne, died 1800. He was of noble family, and entered the army as a sub-lieutenant. He distinguished himself greatly in 1794 under Pichegru, and two years later with the army of the Rhine under Moreau. In 1797 he accompanied Bonaparte to Egypt, and was very successful in reducing Upper Egypt. After the Treaty of El Arish he followed Bonaparte to Italy, took command of the corps of reserve, and, arriving on the field of Marengo at a critical moment, decided the victory by a brilliant charge, 14th June, 1800. He himself fell, mortally wounded by a musket bullet.

**Desault** (dē-sō), Pierre Joseph, one of the most celebrated surgeons of France, was born in 1744, and died in 1795. After some experience in the military hospital at Belfort, he went to Paris in 1764, studied under Petit, and two years afterwards became a lecturer on his own account. His reputation soon increased, and he became principal surgeon in the Hospital de la Charité, and in 1788 was put at the head of the great Hôtel Dieu in Paris. Here he founded a surgical school, in which many of the most eminent surgeons of Europe were educated. A digest of his surgical works was published by Bichat in 1798 (*Œuvres chirurgicales de Desault*).

**Des'cant**, in music, an addition of a part or parts to a subject or melody, a branch of musical composition which preceded the more modern counterpoint and harmony, coming into existence at the end of the eleventh or beginning of the twelfth century.

## DESCARTES

Descartes (dă-kärt), René, a great French philosopher and mathematician, with whom the modern or new philosophy is often considered as commencing. He was born 31st March, 1596, at La Haye, in Touraine, died 11th Feb., 1650. Educated at the Jesuit College of La Flèche, where he showed great talent, he entered the military profession and served in Holland and in Bavaria. In 1621 he left the army, and after a variety of travels finally settled in Holland, and devoted himself to philosophical inquiries. Descartes, seeing the errors and inconsistencies in which other philosophers had involved themselves, determined to build up a system anew for himself, divesting himself first of all of the beliefs he had acquired by education or otherwise, and resolving to accept as true only what could stand the test of reason. Proceeding in this way, he found (*Meditationes de Prima Philosophia*) that there was one thing that he could not doubt or divest himself of the belief of, and that was the existence of himself as a thinking being, and this ultimate certainty he expressed in the celebrated phrase "*Cogito, ergo sum*" (I think, therefore I am). Here, then, he believed he had found the test of truth. Starting from this point Descartes found the same kind of certainty in such propositions as these: that the thinking being or soul differs from the body (whose existence consists in space and extension) by its simplicity and immateriality and by the freedom that pertains to it; that every perception of the soul is not distinct; that it is so far an imperfect finite being; that this imperfection of its own leads it to the idea of an absolutely perfect being; and from this last idea he deduces all further knowledge of truth. Descartes has been rightly called the father of modern philosophy, for in him the modern spirit came into existence. In an age of unrest and ferment his work was that of a great systematizer. He also contributed greatly to the advancement of mathematics and physics, the method of co-ordinates, which has revolutionized geometry, and is of fundamental importance in modern mathematical physics, being due to him. His system of the universe attracted great attention in his time. One of his fundamental doctrines was that the universe is full of matter, there being no such thing as empty space. On this basis he developed the hypothesis of celestial vortices, immense currents of ethereal matter, by which he accounted for the motion of the planets (*Principia Philosophia*, 1644). His works effected a great revolution in the principles and methods of philosophy. In 1647 the French court granted him a pension of 3000 livres, and two years later, on the invitation of Christina of Sweden, he went to Stockholm, where he died.—**BIBLIOGRAPHY:** Sir J. P. Mahaffy, *Descartes*;

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Descent', in law, is the transmission of the right and title to lands to the heir, on the decease of the proprietor, by the mere operation of law. The rule determining to whom an estate belongs, on the decease of the proprietor, is that of consanguinity, or relationship by blood, though with some exceptions, as in the case of the portion or the use of a portion, of a man's property given by the laws of Britain to his widow. The rules of descent, designating what relations shall inherit, and their respective shares, will be determined by the genius and policy of the Government and institutions. Hence the practice of entailments in the feudal system. And wherever the Government is founded in family privileges, or very intimately connected with them, as is the case in all Governments where the hereditarily aristocratical part of the community has a great preponderance, the sustaining of families will very probably be a characteristic feature in the code of laws. Thus, in Britain, all the lands of the father, unless otherwise directed by will, go to the eldest son. (In England, however, this privilege may shortly be abolished, or the succession to real estate assimilated to the succession to personal estate.) In the United States of America this distinction in favour of the eldest son has been abolished, and the laws there are founded upon the principle of equal distribution both of real and personal estate among heirs of the nearest surviving degree. Kindred in blood are divided into three general classes, viz. 1, descendants; 2, ancestors; 3, collateral relatives, that is, those who have descended from the same common ancestor. The civil law computes the degrees by counting the generations up to the common ancestor, as father, grandfather, great-grandfather; or mother, grandmother, great-grandmother; and from him or her down to the collateral relative, as brother, cousin, &c., making the degree of relationship the sum of these two series of generations. Every person has two sets of ancestors, the paternal and maternal, and therefore two sets of collateral relatives. There is also a distinction of collateral kindred, into those of the whole blood and those of the half blood.—Cf. Pollock and Maitland, *History of English Law*.

Deschanel, Paul Eugène Louis, French statesman and tenth President of the French Republic, born at Brussels on 13th Feb., 1856, where his father was in exile for opposition to Napoleon III. Educated at the Collège Sainte Barbe and the Lycée Condorcet, Paris, he was private secretary first to De Marcère, the Home Secretary, in 1876, and then to the Frequier,

Jules Simon, Dreux, Brest, and Meaux, to the Chamber of Deputies in Oct., 1885, for Nogent le Rotrou. In the Chamber of Deputies he soon displayed his power of eloquence, and eventually became the leader of the Progressive Republicans and exponent of the separation of Church and State. His authority, which he owed not only to his eloquence but also to his great tact and correct and dignified conduct during debates, gradually increased in the Chamber of Deputies, and even his political enemies admired his courage and his superiority of intellect. He was consequently elected Vice-President of the Chamber in 1896 and in 1897, and succeeded Henri Brisson as President of the Chamber in 1898, retaining his office till 1902, when M. Léon Bourgeois became President of the Chamber. Re-elected President of the Chamber in 1912, and withdrawing his candidature to the presidency of the Republic in favour of Poincaré in 1913, Deschanel retained his post until 1920, when he was elected President of the Republic by 734 votes. In the meantime, however, his health had given way, and on 23rd May, 1920, he fell out of a moving train, an accident resulting in a prolonged illness. A prompt recovery was at first expected, but this hope soon proved vain. Unable to attend to the duties of his office, he resigned on 16th Sept., and was succeeded by Alexandre Millerand. He was elected to the Académie Française on 18th May, 1899, and his works include: *La Question du Tonkin* (1883), *La Politique Française en Océanie* (1884), *Orateurs et Hommes d'État* (1888), *Figures des Femmes* (1889), *Figures Littéraires* (1889), *La Question Sociale* (1898), *Quatre ans de Présidence* (1902), *Politique Intérieure et étrangère* (1906), *Paroles Françaises* (1911), and *La France Victorieuse* (1919). He died 28th April, 1922.

**Deseada** (de-se-ä'dä), or **Désirade**, one of the Leeward Islands, belonging to the French, in the Caribbean Sea, about 10 miles long and hardly 5 miles broad. The soil is in some places black and good, in others sandy and unproductive. Pop. about 1500.

**Deser'tion**. In the military sense this implies the act of an officer or soldier who, either with the intention of not returning at all or of returning when by reason of his absence it has become impossible for him to perform a given duty, absents himself from His Majesty's service. The essence of the offence is intention, and this must be proved to the satisfaction of the court martial by which the offender is tried. The distance travelled is no criterion, and a man arrested while leaving the barracks in disguise may be tried for attempted desertion. In this connection it should be noted that an attempt to desert, or an attempt to procure another person

to desert, is also an offence, and is punishable under Section 12 of the Army Act equally with the completed act. As far back as the middle of the fifteenth century the crime of desertion by a soldier was made a felony triable by the ordinary law of the land, and with certain interludes death remained the maximum penalty for desertion for some 200 years. The present existing Army Act recognizes two degrees of desertion, i.e. that committed on active service or when under orders for active service, and that committed under other circumstances. Under the former heading the maximum punishment is death; under the latter, imprisonment or penal servitude, according to the number of times the offence has been committed. A soldier convicted of desertion forfeits the whole of his service prior to conviction.

**Desertion**, in law, the term applied to the act by which a man abandons his wife or a wife her husband. Such desertion without due cause is, in England, ground for a judicial separation. Property a wife may have acquired since desertion is protected against her husband, and he may be forced to provide for her maintenance. By Scottish law, where either the husband or wife has deserted and remained separate without due cause for four years, divorce may be obtained.

**Deshoulières** (dä-söl-yär), Antoinette du Ligier de Lagarde, a French woman of much literary reputation in the seventeenth century, born 1638, died 1694. She was the centre of attraction in the best circles of the period, and was elected a member of several learned societies. She wrote in the *Mercur Galant* under the name of Amaryllis, and Boileau has described her in his tenth *Satire*. Among her works are odes, eulogues, idyls, and a tragedy (*Genesic*).

**Desiccation**, a process of dispelling moisture by the use of air, heat, or chemical agents such as chloride of calcium, quicklime, oil of vitriol, and fused carbonate of potash.—*Desiccation cracks*, in geology, are the fissures caused in clayey beds by the sun's heat, and seen in various rock strata.

**Design**, thought, arrangement, or grouping, imagination or invention in works of art. A design is a composition or invention, pictorial, architectural, or decorative. It may be simply an imperfect sketch, as a record of a first thought; or it may be a fully matured work, as a cartoon in preparation for fresco painting, or a drawing to illustrate a book.

**Desmidiaceæ**, or **Desmidiæ**, a family of microscopic, fresh-water Green Algae, group Conjugatæ. They are green gelatinous plants composed of variously formed cells having a bilateral symmetry, which are either free, or in linear series, or collected into bundles or into



star-like groups, and embedded in a common gelatinous coat. Desmidiaceæ differ from Diatomaceæ in their green colour and absence of silica.

**Desmo'dium**, a large genus of leguminous plants, sub-ord. Papilionaceæ, natives of tropical and sub-tropical countries. *D. gyrans* is the telegraph plant, so called from the curious movements performed by the two small lateral leaflets of each leaf, which, at high temperatures, wave up and down like the arms of a semaphore.

**Des Moines** (dè moïn), a city of the United States, capital of the state of Iowa and of Polk County, on the Des Moines River, about 350 miles west of Chicago. Among its chief buildings are the new State house, the State arsenal, university, and opera-houses. There are coal-mines in the vicinity, and the city is a great railway centre with manufactures of flour, machinery, &c. Pop. (1920), 120,500.

**Des Moines**, the largest river in the state of Iowa, rises in the s.w. of Minnesota, and flows in a south-easterly direction till it falls into the Mississippi about 4 miles below Keokuk, after a course of 300 miles.

**Desmoncus**, a genus of tropical American climbing palms, scrambling by means of stout hooks which are modified leaflets.

**Desmoulins** (dâ-mô-lan), Benoît Camille, born in 1760, was conspicuous during the first period of the French Revolution. He was amongst the most notable of the pamphleteers and orators who urged the multitude forward in the path of revolution. He, along with others, prepared the plan for the taking of the Bastille (July, 1789), was one of the founders of the club of Cordeliers, and the promoter of the assembly in the Champ de Mars. In 1789 he began his career as a journalist by the issue of a weekly publication (*Les Révolutions de France et de Brabant*). In 1793 he gave his vote for the death of the king. Having become closely connected with Danton and the party of opposition to Robespierre, and inveighing against the reign of blood and terror, he was arrested on the order of the latter on 30th March, 1794, tried on the 2nd April, and executed on the 5th. He met his fate in an agony of despair.—Cf. F. A. Aulard, *Les Orateurs de la Législative et de la Convention*.

**Desna**, a river in the Ukraine, which rises in the government of, and about 50 miles east of the town of Smolensk, flows through the governments of Orel and Tshernigov till it joins the Dnieper near Kiev. It is 500 miles in length and navigable nearly throughout.

**De Soto**, Hernando, a Spanish explorer and discoverer of the Mississippi, born about 1496, died in 1542. He accompanied expeditions to the New World under Davila and Pizarro, and

played a part in the conquest of Peru. In 1539, on his expedition to Florida, whence after many difficulties he penetrated to the Mississippi, where he was attacked with fever and died.—The name De Soto has been given to a county in the n.w. of Mississippi, and to several places in the United States.

**Des'pot** (Gr. *despotês*), originally a master, a lord; at a later period it became an honorary title which the Greek emperors gave to their sons and sons-in-law when governors of provinces. At present *despot* means an absolute ruler, and in a narrower sense a tyrannous one.

**Dessalines** (dâ-sâ-lên), Jean Jacques, Emperor of Hayti, born in Africa about 1760. He was a slave in 1791, when the insurrection of the blacks occurred in that island, but was set free along with the other slaves in St. Domingo in 1794. His talents for war, his courage, and unscrupulous conduct raised him to command in the insurrections of the coloured people, and after the deportation of Toussaint-L'Ouverture, and the subsequent evacuation of the island by the French, Dessalines was appointed Governor-General for life with absolute power; and the year following (1804) was declared Emperor with the title of Jacques I. But his rule was savage and oppressive, and both the troops and the people, sick of his atrocities, entered into a conspiracy against him, and on 17th Oct., 1806, he was slain by one of his soldiers.

**Dessau** (des'ou), a town in Germany, capital of the former Duchy of Anhalt, in a beautiful valley on the left bank of the Mulde, mostly well built, with fine squares and many handsome buildings. The manufactures consist of woollens, woollen yarn, carpets, machinery, and tobacco. The former ducal palace has a picture-gallery and interesting relics and antiquities. Pop. 50,606.

**De Stendhal**. See *Byle, Marie-Henri*.

**Dester'ro**, now Florianopolis, a seaport of Brazil, capital of the state of Santa-Catharina. The harbour is fortified. Exports are maize, rice, tobacco, and dairy produce. Pop. 31,000.

**Destructors**, *Refuse*, the apparatus or plant used in the cremation of house and factory refuse. Formerly refuse from large towns and populous areas was either disposed of for manurial purposes or spread over waste land, where its presence speedily became a nuisance. The consequent danger to the public health, coupled with the increasing difficulty and cost of its disposal, led to attempts being made to deal with it by more sanitary methods. The first attempts to cremate it in a closed furnace on a large scale, made in London in 1870, were not successful, primarily owing to the unsatisfactory design of the furnace. In 1877, however, there was built in Manchester the forerunner of the



modern destructor. Mr. Alfred Fryer, of Glasgow, has two simple cells, the primary feature of the design being 'the charging of the refuse into the back of the furnace, and drawing out the resulting clinker from the front'. With certain modifications, this design is in general use at the present time. The basic principles underlying their scientific design may be summed up in the following points: (a) Charging at regular intervals, the refuse being dumped into a hopper, and fed into the back of the furnace as a charge, means being taken to prevent undue escape of gases. The moisture having evaporated, the material may then be raked forward on to the fire-bars, where combustion takes place. (b) To avoid nuisance, the resulting gases must be inodorous, which requires a temperature of about 2000° F. This is obtained by passing the products of combustion over the hottest portion of the fire, prior to their passage into the main flue. (c) Removal of the fine dust and particles in suspension in the flue gases by means of spiral chambers at the base of chimney. (d) Provision of forced draught. A well-designed plant should show little, if any, suspended matter in the gases on emission from the chimney. Formerly no use was made of the heat generated, but modern installations now invariably have steam-raising plant incorporated in the design. This power is commonly used to generate electricity. Some portion may be utilized in crushing and screening the clinker, which is frequently used in making slab-paving, or ground fine and used as a substitute for sand in mortar. The following data may be found of service: (a) 60 per cent of the average refuse is combustible. (b) The calorific value may be taken as being one-seventh that of good steam-coal. (c) 100 electrical units may be obtained from each ton of refuse consumed. (d) With forced draught, as much as 100 lb. of refuse has been burnt per square foot of grate area per hour. (e) 250 tons of refuse per annum per 1000 of population may be estimated for.—BIBLIOGRAPHY: W. H. Maxwell, *Removal and Disposal of Town Refuse*; Kempce, *Engineer's Year Book*.

Destutt de Tracy, Antoine Louis Claude, French philosophical writer, born in 1754 of a family of Scottish extraction, died in 1836. As a philosopher he belonged to the Sensationalist school, and considered all our knowledge to be derived originally from sensation. He has been called the logician and metaphysician of the school of Condilliac. Among his chief works are: *Idéologie* (1801), *Logique* (1805), and *Traité de la Volonté* (1815).

Determinant, a mathematical expression which appears in the solution of a system of equations of the first degree.

The solution of the equations

$$\begin{aligned}a_1x + b_1y &= c_1, \\a_2x + b_2y &= c_2,\end{aligned}$$

is given by

$$\begin{aligned}x(a_1b_2 - a_2b_1) &= c_1b_2 - c_2b_1, \\y(a_1b_2 - a_2b_1) &= a_1c_2 - a_2c_1.\end{aligned}$$

Here  $x$  and  $y$  have the same coefficient  $a_1b_2 - a_2b_1$ . This is called a determinant of the second order, and is written

$$\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}.$$

We may now write

$$x \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}.$$

Similarly with three equations,

$$\begin{aligned}a_1x + b_1y + c_1z &= d_1, \\a_2x + b_2y + c_2z &= d_2, \\a_3x + b_3y + c_3z &= d_3,\end{aligned}$$

we find

$$\begin{aligned}x(a_1(b_2c_3 - b_3c_2) + a_2(b_3c_1 - b_1c_3) + a_3(b_1c_2 - b_2c_1)) \\= d_1(b_2c_3 - b_3c_2) + d_2(b_3c_1 - b_1c_3) + d_3(b_1c_2 - b_2c_1).\end{aligned}$$

The coefficient of  $x$ , and the right-hand member, are here determinants of the third order, and the result is written

$$x \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}.$$

When the coefficient of  $x$  is expanded fully, it consists of six terms, half of them positive and half negative, each term being the product of three letters, one from each row and one from each column. Thus in every term, such as the leading term  $a_1b_2c_3$ , the three letters  $a, b, c$ , and the three suffixes 1, 2, 3, all occur once and once only. With regard to the signs, we note that if the letters  $a, b, c$  are always kept in this order, an interchange of two suffixes changes the sign. Thus, e.g. we may start from  $+a_1b_2c_3$ , interchange the suffixes 2 and 3, and thus find  $-a_1b_3c_2$ . Again, if in the latter term  $-a_1b_3c_2$  we interchange the suffixes 1 and 3, we find  $+a_3b_1c_2$ . It is easy to verify that after any number of interchanges of this kind a particular term will always come up with the same sign.

Thus the interchange of two rows (and similarly of two columns) changes the sign of the determinant. It follows that if two rows (or two columns) are identical, the determinant is zero. It is now easy to define functions of  $n^2$  letters, arranged in a square array of  $n$  rows

and  $n$  columns, with similar properties to those observed above in the case of determinants of the third order. Determinants are very extensively used in higher algebra, co-ordinate geometry, and other branches of mathematics. See also *Elimination*.—BIBLIOGRAPHY: C. Smith, *Algebra*; T. Muir, *Theory of Determinants*.

**Determinants**, in biology, the name applied by Weismann to hypothetical particles contained in the nuclei of germ-cells, which determine the existence and nature of the various parts of the body of the embryo. The theory of determinants is part of an elaborate attempt to explain the facts of heredity on a mechanical basis. Although it may serve as a working hypothesis, it is regarded with disfavour by many experts, and may be regarded as an elaboration of the 'provisional theory of pangenesis' advanced by Darwin.

**Determinism**, a term employed by recent writers, especially since J. Stuart Mill, to denote a philosophical theory which holds that the will is not free, but is invincibly determined either—according to the older form of the theory—by a motive furnished by Providence, or—according to the modern form—by the aggregation of inherited qualities and tendencies. Biological determinism maintains that each of our voluntary acts finds its sufficient and complete cause in the physiological conditions of the organism. Psychological determinism ascribes efficiency to the psychical antecedents. Opposed to determinism is the doctrine of indeterminism or indifferentism. See *Free-will*.

**Det'inue**, in law, the form of action whereby a plaintiff seeks to recover a chattel personal unlawfully detained.

**Det'mold**, a town, Germany, capital of Lippe-Deinold, on the left bank of the Werra, 50 miles south-west of Hanover, with a new and an old palace (or castle), good public library, and museum. In the vicinity a colossal statue has been erected to the Hermann or Arminius who overthrew the Roman general Varus and his legions in a battle which was fought near this place. The Senner race of horses is bred near Detmold. Pop. 14,295.

**Det'onating Powders**, certain chemical compounds which, on being exposed to heat or suddenly struck, explode with a loud report, owing to one or more of the constituent parts suddenly assuming the gaseous state. The chloride and iodide of nitrogen are very powerful detonating substances. Mercuric fulminate or fulminating mercury ( $C_2HgN_2O_4$ ) explodes violently when forcibly struck or when heated to  $180^\circ$  F. It is used for making percussion caps, and in detonators for exploding guncotton and nitro-glycerin preparations. Silver fulminate ( $C_2Ag_2N_2O_4$ ) explodes even more violently.

**Detonating Tube**, a species of eudiometer,

being a tube of glass, of small diameter, used for detonating, and is generally graduated into centesimal parts, and perforated by two opposed wires for the purpose of passing an electric spark through the gases which are introduced into it, and which are confined within it over mercury and water.

**Detroit** (de-troit'; Fr. *détroit*, a strait or channel), a flourishing port and city of the United States, the largest town in Michigan, situated on the Detroit River, connecting Lakes Erie and St. Clair. The site rises gradually from the river, and the city is generally well built. Among the chief edifices are the city hall, the house of correction, post office, and opera-house. Detroit has increased very rapidly, a fact which is due to its admirable position for trade, and to its connections with a region into which a constant tide of emigration is flowing. Among the industrial establishments are saw-mills, flour-mills, building-yards for ships and boats, foundries, tanneries, blast-furnaces, pork-packing establishments, tobacco and cigar manufactories, and locomotive works. The harbour is one of the finest in the United States, and has a depth of water sufficient for the largest vessels. Detroit owes its origin to the French, who visited the site in 1648 and erected the Fort Pontchartrain in 1701. Pop. 688,028 (1919).

**Detroit River**, or **Strait of St. Clair**, a river or strait of North America which runs from Lake St. Clair to Lake Erie. It is 28 miles long, and of sufficient depth for the navigation of large vessels. It is about  $\frac{1}{2}$  mile wide opposite Detroit and enlarges as it descends.

**Dettingen** (det'ing-en), the name of several places in Germany, amongst which is a village of Bavaria, on the right bank of the Main, famous for the victory gained by the English and Austrians under George II of England over the French in 1743.

**Deuca'lon**, in Greek mythology, the son of Prometheus and father of Hellen, ancestor of the Hellenes. According to tradition he saved himself and his wife, Pyrrha, from a deluge which Zeus had sent upon the earth, by building a ship which rested upon Mount Parnassus. To repair the loss of mankind they were directed by an oracle to throw stones behind them; the stones thrown by Deucalion became men, those thrown by Pyrrha women.

**Deus ex Machinâ** (mak'i-na; Lat., 'a god out of the machine'), a phrase used to designate the resorting to supernatural causes to explain phenomena that one is not able to account for by natural means. The phrase is taken from the practice on the classical stage of introducing a god from above by means of some mechanical contrivance in order to effect a speedy *dénouement* of the plot.

**Deuteronomy**, the second law), the name of the second of the *Pentateuch* (q.v.). Until the seventeenth century it was believed to have been written by Moses, but now it is generally held to be a compilation, the bulk of it having been written in the reign of Manasseh, or according to other scholars in the reign of Josiah. At any rate the book was discovered or rediscovered while Josiah was king (2 *Kings*, xii). It represents the latest phase in the development of the teaching of Moses. Its chief aim is to combat idolatry, and to concentrate the religious life of the country at Jerusalem. It has a lofty moral tone. Of one passage (vi, 4 and 5) Christ said: "On these two commandments hang all the law and the prophets" (*Matt.* xxii, 40), and all His answers to the Tempter in the Wilderness are taken from the book of *Deuteronomy*.

**Deutz** (doits), a town in Prussia, on the right bank of the River Rhine, opposite the city of Cologne, with which it communicates by a bridge. It is strongly fortified as part of the defences of Cologne, in which it is now incorporated. There are some manufactories of porcelain and glass, also an iron-foundry and machine-works. Pop. 17,000.

**Deutzia**, a genus of plants, nat. ord. Saxifragaceæ, containing seven or eight species, all of which are interesting from the beauty of their flowers, some of them favourite garden and greenhouse plants. They are small shrubs indigenous to China and Japan, and Northern India.

**De Valera**, Eamon, Irish Republican, born at New York in 1883, his father being a Spaniard, and his mother an Irishwoman. Educated at the Royal University of Ireland, he early became known for his revolutionary activities. In 1917 he was elected president of the Gaelic League and was arrested as an agitator. Elected to Parliament in 1918, while he was in prison, he refused to take his seat. He was elected 'President' of the so-called 'Irish Republic' soon afterwards, and in Feb., 1919, escaped from prison and reached New York, where he started an active propaganda and began to raise funds for the Irish cause. He returned to Ireland in 1921.

**Dev'enter**, an old town in Holland, province of Overijssel, 8 miles north from Zutphen, at the confluence of the Schipbeek and IJssel. Its industries embrace carpets, cast-iron goods, printed cottons, hosiery, and a kind of cake called *Deventer Koek*. It has a large export trade in butter. Pop. 32,483 (1918).

**Dev'er-on**, a river of Scotland belonging to Aberdeenshire and Banffshire, 60 miles long. It flows into the Moray Firth at Banff.

**Deviation of the Compass**, the deflection of a ship's compass needle from the magnetic meridian, caused by adjacent iron. Hard iron

is very retentive of a magnetic state, and is specially liable to become magnetized during a hammering process, as in the building of the ship. Soft iron easily receives or loses magnetism, and its magnetic state varies with every shifting of the ship's head. The effect of the former can be counteracted by magnets suitably placed near the compass, that of the latter by spheres of soft iron. The ship is swung, and the compass errors found in the various positions. The effects of the several contributing causes can then be separated, and the nature of the correctors necessary inferred with considerable accuracy. When these have been provided, the small residual errors for different positions of the ship are determined, and a table is constructed from which the navigator may read the slight correction to apply to the indication of his compass in steering any desired course.

**Device**, a name common to all figures, ciphers, characters, rebuses, and mottoes which are adopted by a person or a family by way of badge or distinctive emblem, often a representation of some natural body, with a motto or sentence applied in a figurative sense.

**Devil** (Gr., *diabolos*, a slanderer or accuser), in theology, the name given to a fallen angel, who is the instigator of evil, and the ruler of darkness. Most of the old religions of the East acknowledge a host of devils. The doctrine of Zoroaster, who adopted an evil principle called Ahriman, opposed to the good principle and served by several orders of inferior spirits, spread the belief in such spirits among the people. The Greek mythology did not distinguish with the same precision between good and bad spirits. With the Mohammedans *Eblis*, or the devil, was an archangel whom God employed to destroy a pre-Adamite race of *jinn*s, or genii, and who was so filled with pride at his victory that he refused to obey God. The Satan of the New Testament is also a rebel against God. He uses his intellect to entangle men in sin and to obtain power over them. But he is not an independent self-existent principle like the evil principle of Zoroaster, but a creature subject to omnipotent control. The doctrine of Scripture on this subject soon became blended with numerous fictions of human imagination, with the various superstitions of different countries, and the mythology of the pagans. The excited imaginations of hermits in their lonely retreats, sunk as they were in ignorance and unable to account for natural appearances, frequently led them to suppose Satan visibly present; and innumerable stories were told of his appearance, and his attributes—the horns, the tail, the cloven foot,—distinctly described. Theology has always treated the devil from a psychological or ethical

standpoint. From the New Testament we hardly learn more regarding the devil than that he has a distinct personality; that he is a spirit or angel who in some way fell; that he is devoid of truth and of all moral goodness, always warring against the soul of man and leading him towards evil; that he has demons, spirits, or angels under him who work his will, and enter into or 'possess' men; but of his or their origin, original state, or fall, we really learn nothing.—BIBLIOGRAPHY: Mayer, *Historia Diaboli*; Lecanu, *Histoire de Satan, sa chute, son culte, ses manifestations, ses œuvres*; Carus, *History of the Devil*.

Devil-fish, the popular name of various fishes, one of them being the angler. Among others the name is given to several large species of ray (especially *Ceratoptera Vampyrus* which attains the breadth of 20 feet) occasionally captured on the Atlantic and Pacific coasts of America, and much dreaded by divers, whom they are said to devour after enveloping them in their vast wings. During gales of wind or owing to strong currents these immense fish are driven into shoal water, and, being unable to extricate themselves, fall an easy prey to the fishermen, who obtain considerable quantities of oil from their livers. The name is also applied to the larger eight-armed cephalopod molluscs belonging to *Octopus* and allied genera. A combat with one of these is described in Victor Hugo's *Toilers of the Sea*.

Devil's Bit, the common name of a British species of scabious (*Scabiosa succisa*), nat. ord. Dipsacaceæ. It has heads of blue flowers nearly globular, and a fleshy root, which is, as it were, cut or bitten off abruptly. It flowers from June to October, and is common in meadows and pastures.

Devil's Bridge, a name for several bridges in wild situations; one being in Cardiganshire, spanning a gorge of the Mynach; another in Switzerland, over which the St. Gothard Railway crosses the Reuss.

Devil's Parliament, the name given to a Parliament convened by Henry VI, which met at Coventry in 1459 and unjustly accused the Duke of York of high treason.

Devil's Punch-bowl, a small lake of Ireland, near the Lakes of Killarney, between 2000 and 3000 feet above the sea, supposed to be the crater of an ancient volcano. The name is also given to Highcomb Bottom, a glen in Surrey.

Devil's Wall, in the south of Germany, a structure which was originally a Roman rampart, intended to protect the Roman settlements on the left bank of the Danube and on the right bank of the Rhine against the incursions of the Teutonic and other tribes. Remains of it are found from the Danube, in Bavaria, to Bonn, on the Rhine.

Devil-worship, the name given to the devil, an evil spirit, a malignant power, or the personified evil principle in nature, by many of the primitive tribes of Asia, Africa, and America, under the assumption that the good deity does not trouble himself about the world; or that the powers of evil are as mighty as the powers of good, and have in consequence to be bribed and reconciled. There is a sect called devil-worshippers inhabiting Armenia and the valley of the Tigris, who pay respect to the devil, to Christ, and to Allah or the supreme being, and also worship the sun.

Devise, in law, usually the disposition of real estate by will, but also sometimes applied to any gift by will, whether of real or personal estate.

Devitrification. Glass which has been kept for a considerable time at a temperature just below its fusion-point gradually becomes opaque or crystalline in appearance; this phenomenon is spoken of as *devitrification*. Poor glass, badly prepared window-glass, and glass which has been subjected to strain tend to devitrify on exposure to air, some of the ingredients separating in a crystalline form.

Devizes, a town in England, county of Wilts, giving name to a parliamentary division, finely situated on a commanding eminence, 82 miles west by south of London. The name is derived from the Lat. *divisæ* (terra, divided lands), because the ancient castle of Devizes was built at the meeting-place of three different manors. Agricultural engines and implements are made, and malting is carried on. Pop. 6740.

Devon, or Devonshire, a maritime county in the s.w. of England, its northern coast being on the Bristol Channel and its southern on the English Channel; area, 1,671,364 acres, the county being the third largest of England. Its principal rivers are the Torridge and the Taw, flowing north into the Bristol Channel; and the Exe, Axe, Teign, Dart, and Tamar, flowing into the English Channel. From Exeter to the confines of Cornwall extends the wide and barren tract called Dartmoor; but the vale of Exeter, comprising from 120,000 to 180,000 acres, and the south extremity of the county called *South Hams*, limited by a line drawn from Torbay to Plymouth Sound, are amongst the most fertile districts of England. Tin, lead, iron, copper, manganese, granite, and the clay used by potters and pipe-makers are the chief mineral products. The geological formation of the Old Red Sandstone is so largely developed that the term Devonian has to some extent become its synonym. Agriculture is in a somewhat backward state, owing, probably, to the general preference given to dairy husbandry, for which the extent and richness of its grass-lands make the county most

suitable. Wheat, oats, peas, and potatoes are the principal crops. About three-fourths of the county is under crops or in pasture. There is a large trade in butter, cheese, and live-stock, and the 'clotted' cream and cider of Devonshire are well known as specialties of the county. There are seven parliamentary divisions, each with one member. Pop. 699,708.

—BIBLIOGRAPHY: *Victoria County History, Devonshire*; F. J. Snell, *Devonshire, Historical, Descriptive, and Biographical*.

**Devonian System**, in geology, a name originally given to rocks in Devonshire and Cornwall, intermediate between the Silurian and Carboniferous strata, and consisting of sandstones, calcareous slates and limestones, &c. They are divided into lower, middle, and upper series, the middle most abounding in fossils, including corals, crinoids, brachiopods, and molluscs. Devonian rocks occupy a large area in Central Europe, as well as in the United States, Eastern Canada, and Nova Scotia. The terrestrial and lacustrine equivalents are known as the Old Red Sandstone.

**Devonport**, formerly a county borough and port of England, county of Devon, contiguous to Plymouth. It is the seat of one of the royal dockyards, and an important naval and military station. A bastioned wall and fosse defend the town on the north-east and south sides, while the sea entrance is protected by heavy batteries on Mount Wise. Connected with the dockyards and fortifications are the gun wharf, foundries, machine-works, rope-walks, store-houses, and naval and military barracks. It has no special trade beyond that connected with the dockyards and Government works. Formerly a parliamentary borough, returning two members to Parliament, Devonport now gives its name to a parliamentary division of Plymouth, with which it is amalgamated since Nov., 1914. Pop. 84,370.

**Devonshire**, Spencer Compton Cavendish, eighth Duke of, long known as Marquess of Hartington, born in 1833, died 1908. He was the eldest surviving son of the seventh Duke of Devonshire, whom he succeeded in the dukedom in 1891. He was educated at Trinity College, Cambridge, where he graduated as M.A. in 1854. He was attached in 1856 to Earl Granville's Russian mission, and in 1857 was elected as a Liberal one of the members for North Lancashire. In 1868 he was for a short time a Lord of the Admiralty, and he then became Under-Secretary for War, being raised to Cabinet rank as War Secretary in 1866. In 1868 he lost his seat for North Lancashire, but became Postmaster-General under Gladstone, and was returned for the Radnor boroughs. In 1871 he was appointed Chief Secretary for Ireland. He went out with the Gladstone ministry in 1874,

and on Gladstone's retirement he became the leader of the Liberal party. On the fall of the Conservative Government in 1880 he was elected for North-East Lancashire, and became Secretary for India under Gladstone, being transferred to the War Office in 1892. In the general election of 1895 he was returned for the Rossendale division of Lancashire. He strenuously opposed Gladstone's Home Rule Scheme of 1886, and became the leader of the Liberal Unionists, but long declined to take office in the Cabinet. In 1895, however, he became Lord President of the Council, and from 1900 to 1902 he was President of the newly-instituted Board of Education. In 1903 he withdrew from co-operating with Mr. Balfour as Premier, mainly because he disliked the fiscal changes proposed by Chamberlain. He then accepted the position of head of the Free-Trade Unionists.

**Dew** is the name given to the minute drops of water which at certain times appear by night upon grass, flowers, foliage, and other surfaces which readily radiate heat. The first attempts at a scientific explanation of dew were made early in the nineteenth century, when Dr. Wells propounded his theory on the subject. According to this, the origin is to be found in the moisture previously contained in a vaporous state in the atmosphere. During the day the earth both absorbs and emits heat, but by night its supply of warmth is cut off, while it continues, under favouring circumstances, to lose heat by radiation into surrounding space. For any given state of the atmosphere, in respect of the amount of aqueous vapour it contains in a specified volume, there is a certain temperature at which it can hold just that amount and no more in suspension. If it be cooled to that temperature, it begins to deposit its moisture in the liquid form, and if the cooling proceeds further, more and more is deposited. This particular temperature is the *dew-point* appropriate to the given state of humidity of the air. If the dew-point is below 82° F., the vapour will, when the dew-point is reached, pass directly into the solid form and be deposited as hoar-frost. While there is a certain amount of truth in the foregoing theory, it does not contain the whole facts of the case. Dr. John Aitken, of Falkirk, Stirlingshire, established by experiments that in most cases probably the dew found on plants does not come mainly from the atmosphere. To some extent it exudes from the plants themselves. They derive moisture from the soil, and in the process of supplying their tissues it passes to their outer surfaces, whence in the daytime it is evaporated into the air. By night the fall of temperature checks evaporation of this moisture, and when it reaches their surfaces, it may remain there in the form of dew-drops. Also, moisture

is condensed out of the atmosphere upon the cooler plant surfaces, but even this has more often been yielded not long before to the atmosphere through the medium of the plant tissues, so that upon the whole the plants play a much more important part in the process than had been supposed. Dew is most copiously produced when there is a large difference between the day and night temperatures. Hence it is favoured by the absence of clouds, which would throw back much of the heat radiated from the earth. Other favouring circumstances are a still condition of the atmosphere, good radiating surfaces, and an abundant supply of moisture in the soil.

Dewar (dū'ar), Sir James, scientist, born at Kincardine-on-Forth, 1842, educated at Dollar Academy, Edinburgh University—where he was assistant to Lord Playfair when professor of chemistry—and Ghent. In 1873 he was elected Jacksonian professor of experimental philosophy at Cambridge, an office which he still holds, and in 1879 a professorial fellow of St. Peter's College. In the latter year he also became Fullerton professor of chemistry at the Royal Institution, London. He is a fellow of the Royal Society, has been awarded several medals and prizes for his scientific researches, including the Rumford medal in 1894 for his investigations into the properties of matter at its lowest temperatures, this branch of science, with which the liquefaction of air and gases is connected, being peculiarly his own. He was the first to reduce hydrogen gas to the liquid and solid form. Together with Sir F. Abel, he was the discoverer of cordite. He is an honorary graduate of several universities, a late president of the Chemical Society and vice-president of the Royal Society, and was president of the British Association in 1902. He has contributed numerous papers to the proceedings of the learned societies of Great Britain, and was knighted in 1904. His collected papers on spectroscopy appeared in 1915. He died in March, 1923.

Dewar Flask, a flask devised by Dewar for the examination of liquefied gases. It consists of an inner vessel surrounded by a vacuum, which much reduces loss or gain of heat by the liquid. The principle now finds practical application in the 'Thermos Flask'.

Dewās, a native state of Central India consisting of two combined states with two chiefs. Total pop. 250,000. Dewās, the chief town, has a pop. of 5200.

Dewberry (*Rubus cæsius*), a European plant belonging to the ord. of the Rosaceæ, and to the same genus as the bramble, from which it is distinguished by its smaller berries, with fewer grains, and by the bloom, resembling dew, with which they are covered, and from which the plant derives its name. It is common in some

parts of England. Canadian dewberry (*R. procumbens*) yields a much superior fruit.

De Wet, Christian Rudolf, Boer general, born 1854 in the Orange Free State. His father removing into the Transvaal, he fought as a field-cornet at Majuba. As member of the Volksraad (1889-97) he helped to draw the two Dutch republics together, and in the South African War commanded first in Natal, and then in the west under Cronje, whose rescue at Paardeberg he attempted, but unsuccessfully. At March, 1900, he distinguished himself by his attacks on the British lines of communication, and by his skill in evading capture. He became commander-in-chief of the Free State forces, and was the only undefeated Boer general at the end of the war, after which he, with Louis Botha and Delarey, came to Europe to collect funds for his countrymen. A member of the Legislative Assembly and Minister of Agriculture, Orange Free State, from 1907 to 1914, he joined the rebellion at the outbreak of the European War. Captured at Waterburg on 1st Dec., he was sentenced to a fine of £2000 and six years' imprisonment, but was soon released. He died 3rd Feb., 1922.

Dewey, George, American naval officer, born at Montpelier, Vermont, 26th Dec., 1837, died 16th Jan., 1917. He began active service in the Mediterranean squadron, and in 1862, under Farragut, he was present at the passage of Forts Jackson and St. Philip. Lieutenant-commander in 1865, commander in 1872, he was in command of the Asiatic squadron in 1898, when he destroyed the Spanish fleet at Manila on 1st May. He was made Admiral of the Navy and was thanked by Congress. From 1900 till his death he was President of the General Board of the Navy.

Dewey, John, American philosopher and psychologist, born at Burlington, Vermont, 20th Oct., 1859. Educated at the University of Vermont, he received his Ph.D. degree from Johns Hopkins University. Professor of philosophy at the Universities of Minnesota, Michigan, and Chicago, where he was also director of the School of Education, he became professor of philosophy at Columbia University in 1904. He is one of the two (William James being the other) American leaders of *pragmatism*, a philosophical conception according to which questions that have no bearing on experience and on life have no significance whatever, and are meaningless. (See *Pragmatism*.) His works include: *Outlines of a Critical Theory of Ethics* (1881), *Study of Ethics* (1894), *My Pedagogical Creed* (1897), *The School and Society* (1900), *Studies in Logical Theory* (1903), *How we Think* (1909), *Interest and Effort in Education* (1913), *Democracy and Education* (1916), *Letters from China and Japan* (1920).

**De Wint, Peter**, English landscape painter in water-colours, born 1784, died 1849. He studied in the schools of the Royal Academy, where he occasionally exhibited; but most of his pictures were shown in the exhibitions of the Water-colour Society. English scenery was his favourite subject. He occasionally painted in oil with marked success. Several of his pictures are in the National Gallery and the Victoria and Albert Museum.

**De Witt, Jan**, Grand-Pensionary of Holland, celebrated as a statesman and for his tragical end, was the son of Jacob de Witt, burgomaster of Dort, and was born in 1625. He became the leader of the political party opposed to the Prince of Orange, and in 1652, two years after the death of William II, was made Grand-Pensionary. In 1665 the war with England was renewed, and conducted by De Witt with great ability till its termination in 1665. In 1672 Louis XIV invaded the Spanish Netherlands and involved Holland in war. De Witt's popularity, already on the decline, suffered still further in the troubles thus occasioned, and he felt it necessary to resign his office of Grand-Pensionary. At this time his brother Cornelius, who had been tried and put to torture for conspiring against the life of the young Prince of Orange, lay in prison. Jan de Witt went to visit him, when a tumult suddenly arose amongst the people, and both brothers were murdered, 20th Aug., 1672. De Witt was a man of high character, simple and modest in all his relations.—Cf. Motley, *History of the United Netherlands*.

**Dew-point**, the temperature at which the air is saturated with the water-vapour which it contains. If the temperature of the air falls to the dew-point, dew is deposited. The dew-point is determined by means of an instrument called a hygrometer. When the air is 'dry', the dew-point is low, and evaporation proceeds rapidly, whilst a 'moist' atmosphere is one whose temperature is near the dew-point, and in which evaporation takes place slowly.

**Dewsbury**, a town, England, in the West Riding of Yorkshire, and 30 miles south-west of the town of York, chiefly engaged in the manufacture of heavy woollen cloths, including blankets, carpets, rugs, flannels, and baizes. In 1802 it was made a municipal borough; in 1867 a parliamentary borough, returning one member. Pop. of municipal borough, 53,351.

**Dexter**, a term meaning on the right-hand side, chiefly used in heraldry. The *dexter chief point* is a point in the right-hand upper corner of the shield, being in the dexter extremity of the chief.

**Dextrine**, or British Gum,  $(C_6H_{10}O_5)_x$ , a

generic name applied to soluble gummy substances intermediate between starch and glucose. They are prepared from starch by the aid of dilute mineral acids or of enzymes, and are usually named according to the colour they give with iodine, e.g. erythro-dextrine, &c. When heated with dilute acids, they are transformed into glucose. They are white, odourless substances, and are good substitutes for gum-arabic. Dextrine is used in calico printing for thickening colours; for the preparation of gums, and for stiffening cloth.

**Dextro-compounds**, bodies which cause the plane of a ray of polarized light to rotate to the right. Dextrine itself, dextro-glucose, naturally occurring tartaric acid, malic acid, cinchonine, and many other bodies have this property; while others, which have the opposite effect, of causing the plane to rotate to the left, are called *levo-compounds*.

**Dey**, an honorary title formerly bestowed by the Turks on elderly men, and assumed by the rulers (under the Turkish Sultan) of Algiers, Tripoli, and Tunis.

**Dhalak** (dhā-lāk'), an archipelago of the Red Sea, belonging to the Italian territory of Eritrea. It consists of nearly 100 islets, mostly uninhabited, clustering round the Island of Dhaluk-el-Kebir, which is about 85 miles long by 30 miles broad. This island possesses a pearl-fishery.

**Dhar** (dhār), a small native state in Central India, with an area of about 1740 sq. miles. The soil is fertile, and yields wheat, rice, and opium. Pop. 169,474.—The capital is of the same name, is surrounded by a mud wall, and has some striking buildings. Pop. 10,000.

**Dhārangaon**, a town of Hindustan, in Khandesh district, Bombay. Pop. 15,000.

**Dharmasala**, a hill station with military cantonments, in Kangra district, Punjab, India. Pop. 6170.

**Dharwar**, the chief town of Dharwar district, in the Bombay Presidency, Hindustan, a straggling place with some trade. There is a fort well planned and strongly situated, but now falling into ruins, and military cantonments at 2 miles' distance. Pop. 32,000.—The Dharwar district has an area of 4535 sq. miles; pop. 1,051,314.

**Dhawala'giri**, or Dhaulāgiri, one of the highest peaks of the Himalayas, in Nepal; height, 26,828 feet.

**Dhole** (dōl), the Cingalese name for the wild dog of India (*Cyon dukhunensis*). It is distinguished from the genus *Canis* or dog proper by its having one molar fewer in either side of the lower jaw. It is of a fox-red or rufous-fawn colour, in size between a wolf and a jackal, and hunts always in packs.

**Dholera** (dhō-lā'ra), a town of Hindustan,



A, Dexter chief point.

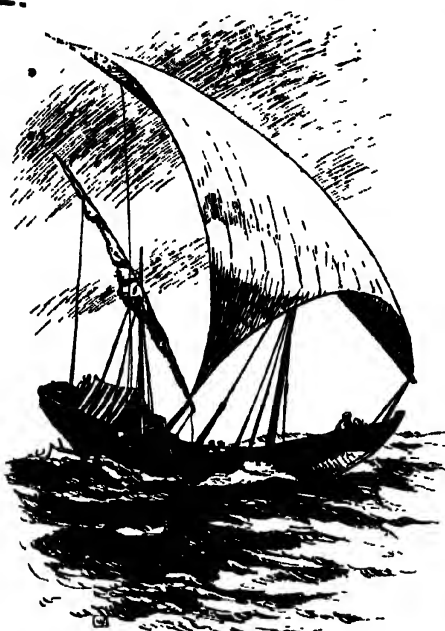


Bombay Presidency, on a stream entering the Gulf of Cambay, an important cotton-mart. Pop. 10,190.

Dholka, a town of Hindustan, Bombay Presidency, probably one of the oldest towns in Gujarat. Pop. 16,700.

Dholpur, native state of Central India, Rájputána; area, 1155 sq. miles; pop. 263,188.—The capital is also called Dholpur. Pop. 9750.

Dhow (dou), an Arab sea-going vessel, ranging from a comparatively small size up to 200



Arab Dhow

tons burden, with one mast and a large triangular (*laken*) sail. It is used for merchandise and is often employed in carrying slaves from the east coast of Africa to Arabia.

Dhūllá, a town of Hindustan, Khandesh district, Bombay Presidency. Pop. 22,000.

Diabase, originally an equivalent of diorite; then used for chloritic igneous rocks of the Intermediate series of various grain; and now usually for a type of dolerite in which the felspar is embedded in augite.

• *Diabē'tes* is a disease characterized by great thirst, a voracious appetite, and the passage of large quantities of saccharine urine, while there is usually marked emaciation and debility. As a rule the skin is dry and the patient does not perspire. Skin irritations (pruritus) of an intense type occur frequently and cause much discomfort. Constipation is the rule, but the digestion

usually remains good, and enormous quantities of food are taken without causing disturbance.

Acute and chronic forms are recognized, but there is no essential difference, except that in the former the patients are younger, the course more rapid, and the emaciation more marked. Beyond the large quantity, the outstanding feature of the urine is the presence of sugar, varying from 2 per cent in mild cases to 10 per cent in severe cases.

The disease is due to disturbance in the carbohydrate metabolism, with the result that these carbohydrates are not properly assimilated, but passed as sugar in the urine. Much research has been undertaken to find what organ or organs of the body cause this defect in metabolism, and recent work in connection with the pancreas has established a definite relationship between cells in that organ and the disease.

In treatment the main consideration is to reduce the carbohydrates in the dietary, and many diets have been produced for this purpose.

Diabetic patients may take:—liquids: clear soups, lemonade, coffee, tea, cocoa (without sugar), soda-water, and such like waters or milk (in moderation); animal foods: fish of all sorts, fresh meat, poultry, game, eggs, butter, cream-cheese; vegetables: lettuce, tomatoes, spinach, radishes, asparagus, water-cress, cucumbers, chichory, mustard; fruits: lemons, oranges, and in moderation currants, plums, cherries, pears, apples (tart), melons, raspberries, strawberries, nuts; bread: gluten bread, almond or coco-nut biscuits. A substitute for bread is one of the greatest difficulties, as many gluten foods are very unpalatable.

Further, it is important to observe strict personal hygiene and to take moderate exercise, lead a regular, quiet life in an equable climate, and above all to avoid worries of any sort. In acute cases the disease may run a very rapid course, coma frequently supervening a few days before death, but chronic cases may live for ten to twenty years.

**Diabetic Sugar.** Sugar is present in normal urine in very small amount—so small that it cannot be detected by the ordinary tests. In diabetes the percentage of sugar in the urine may rise, in mild cases, to  $1\frac{1}{2}$  to 2 per cent, and in severe cases it may reach to 10 per cent.

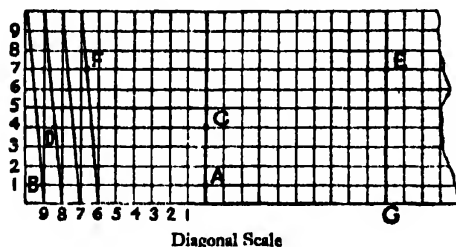
**Diablerets** (dē-āh-lé-rā), **Les**, a mountain group of the Bernese Alps, Switzerland, between the cantons Vaud and Valais. The highest peak has a height of 10,620 feet.

**Diachylon** (di-ak'ī-lon), a substance prepared by heating together oxide of lead or litharge, olive-oil, and water, until the combination is complete, and replacing the water as it evaporates. It is used for curing ulcers, and is the basis of many plasters.



**Di'adem** (Gr. *diadein*, to bind round), an ancient ornament of royalty. It was originally a head-band or fillet made of silk, linen, or wool, worn round the temples and forehead, the ends being tied behind and let fall on the neck, as seen in old representations of the diadem of the Indian Bacchus. In later times it was usually set with pearls and other precious stones. The term is also used as equivalent to crown or coronet.

**Dis'resis**, a separation of one syllable into



two, also the mark (..) by which this separation is distinguished, as in *aërial*.

**Diagno'sis**, in medicine, the recognition of diseases by their distinctive signs or symptoms; the discovery of the true nature and seat of a disease.

**Diag'onal Scale**, a scale which consists of a set of parallel lines drawn on a ruler, with lines crossing them at right angles and at equal distances. One of these equal divisions, namely, that at the extremity of the ruler, is subdivided into a number of equal parts, and lines are drawn through the points of division obliquely across the parallels. With the help of the compasses such a scale facilitates the laying down of lines of any required length to the 200th part of an inch. The length 1·07 inches, for example, is given by EF in the figure. Similarly AB = ·91 inch, CD = ·84 inch.

**Diag'oras**, ancient Greek poet and philosopher, born in Melos, an island of the Cyclades, and flourished about 425 B.C. He spent a great part of his life in Athens. Like his teacher, Democritus, he attacked the prevailing polytheism, and sought to substitute the active powers of nature for the divinities of the Greeks. On this account he had to leave Athens.

**Di'agram** (Gr. *diagraphein*, to describe), a figure or geometrical delineation applied to the illustration or solution of geometrical problems, or any illustrative figure in which outlines are chiefly presented, and the details more or less omitted.

**Dial**, or **Sun-dial**, an instrument for showing the hour of the day from the shadow thrown by a *stile* or *gnomon* upon a graduated surface while the sun is shining. This instrument was known

from the earliest times amongst Egyptians, Chaldeans, and Hebrews. From those Eastern nations it came to the Greeks. It was introduced into Rome during the first Punic War. Dials are of various construction, horizontal, inclined, or upright, the principle in every case being to show the sun's distance from the meridian by means of the shadow cast by the stile or gnomon. The stile is made parallel with the earth's axis, and may be considered as coinciding with the axis of the sun's apparent diurnal motion. Consequently, as the sun moves westwards the shadow of the stile moves round opposite to it, in the same direction, falling successively on lines drawn to represent the hours of the day. The dial, of course, gives true solar or *apparent* time, which, except on four days of the year, is somewhat different from *mean* time. Dials are now rather articles of curiosity or ornament than of use. —BIBLIOGRAPHY: Leybourn, *The Art of Dialling*; Dawbarn, *The Sun-dial*.

**Di'alect**, the language of a part of a country, or a distant colony, deviating either in its grammar, vocabulary, or pronunciation, from the language of that part of the common country whose idiom has been adopted as the literary language, and the medium of intercourse between well-educated people. Although the use of provincial dialects becomes inconvenient after a language has acquired a fixed literary standard, the study of such dialects is always valuable to



Sun-dial

the philologist for the light they throw on the history of the language. The diffusion of education and of printed books has much relaxed the hold which the provincial dialects of various countries once had on the people, and in general it may be said that the educated classes of any country now speak each of them a uniform language.

**Dialec'tics** (Gr. *dialektike*, from *dialektos*, discourse, dialogue), a philosophic term originally signifying *investigation by dialogue*. It was first

used by Plato to designate the Socratic method. Afterwards it came to denote the art of inference or argument, and in this sense was synonymous with *logic*. The term is used in Kant's philosophy to mean the logic of appearance, or that logic which treats of inevitable tendencies towards error and illusion in the very nature of reason.

**Diallage**, an altered form of the mineral augite, with a lamellar structure, and a sub-metallic lustre on its planes of separation. Schillerstein, or schiller spar is a similar product of the allied but rhombic mineral hypersthene. It forms diallage rock, and enters into serpentine rock.

**Dialling**, the art of making sun-dials; also the art and practice of mine-surveying, in which the theodolite and magnetic needle are employed.

**Diallogue**, a conversation or discourse between two or more persons. The word is used more particularly for a formal conversation in theatrical performances, and for a written conversation or composition, in which two or more persons carry on a discourse. This form was much in favour amongst the ancient philosophers as a medium for expressing their thoughts on subjects. The *Dialogues* of Plato are the finest example. Many of the great French and Italian writers have used this form. In the seventeenth century Fontenelle and Fénelon both wrote *Dialogues des Morts*, a title borrowed from Lucian. Landor's *Imaginary Conversations* (1821-8) is the best production of this kind in English.

**Dialysis**, the process by means of which a crystalline substance may be separated from a colloidal body. Certain substances are capable of passing through parchment, others are not, e.g. a solution containing sugar and silicic acid may be separated by placing the solution in a parchment-paper tube suspended in water; the silicic acid remains in the parchment tube, and the sugar passes through into the surrounding water. The solution is said to be dialyzed.

**Diamagnetic**, a term applied to substances which, when under the influence of magnetism and freely suspended, take a position at right angles to the lines of magnetic force. From the experiments of Faraday it appears that all matter is subject to the magnetic force as universally as it is to the gravitating force, arranging itself into three divisions, the *ferromagnetic*, *paramagnetic*, and *diamagnetic*. Among the former are iron, nickel, cobalt, magnetic oxide of iron, and Heusler's alloy. The more feebly magnetic bodies are classed as paramagnetics, and those which behave as described above are called diamagnetic substances. Among the latter are bismuth, antimony, cadmium, copper, gold, lead,

mercury, silver, tin, zinc, and most solid, liquid, and gaseous substances. A diamagnetic body is one which is not so magnetic as the medium in which it is suspended. The action of bismuth, the strongest diamagnetic substance, is weak when compared with the magnetic action of iron.

**Diamantina**, a city, Brazil, in the diamond-mining district in the state of Minas Geraes. Many of the inhabitants are engaged in the gold and diamond trade; there is industrial activity in diamond-cutting, &c. Pop. about 14,000.

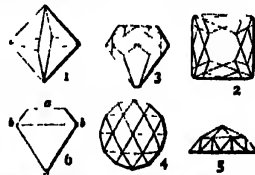
**Diameter** (Gr. *dia*, through, and *metron*, measure), the straight line drawn through the centre of a circle and terminated by the circumference. It thus divides the circle into two equal parts, and is the greatest chord. The length of the diameter is to the length of the circumference of the circle as 1 to 3.14159265 . . . ,



the latter number being an interminable decimal. The name is also given to any chord of a conic which passes through its centre.

**Diamond**, the hardest and one of the most valuable of gems, and the purest form in which the element carbon is found. (See *Carbon*.) It crystallizes in forms belonging to the regular or cubic system, the most common being the regular octahedron and rhombic dodecahedron (twelve faces). The finest diamonds are colourless, perfectly clear, and pellucid. Such are said to be of the finest water. But diamonds are often blue, pink, green, or yellow, and such are highly prized if of a decided and equal tint throughout. The hardness of the diamond is such that nothing will scratch it, nor can it be cut but by itself.

The value of a diamond is much enhanced by cutting facets upon it inclined at certain angles to each other so as to produce the greatest possible play of colour and lustre.



Diamonds, rough and variously cut

What is called the *brilliant* cut best brings out the beauty of the stone. Its upper or principal face is octagonal, surrounded by many facets. But this form of cutting requires an originally well-shaped stone. For other diamonds the *rose* cut is used. In this form six triangles are cut on the top so that their apices meet in a point called the summit. Round this are disposed other facets. Stones which are too thin to cut as rose-diamonds are cut as *table*-diamonds, which have a very slight play of colour. In the cut, fig. 1 is the diamond in its rough state; fig. 2 is the vertical, and fig. 3 the internal appearance of a brilliant; fig. 4 the

vertical, and fig. 5 the lateral appearance of a rose-cut diamond; in fig. 6 the flat portion *a* in a cut stone is called the *table*; the part *a b b*, which projects from the setting, is the *front*, the part *b b c*, sunk in the setting, is the *back* or *culasse*, while the line *b b* is the *girdle*. The art of cutting and polishing the diamond was unknown in Europe till the fifteenth century, and the stone itself was not nearly so highly valued in the Middle Ages as the ruby. Diamonds are valuable for many purposes. Their powder is the best for the lapidary, and they are used for jewellery watches, and in the cutting of window- and plate-glass. When used as a glazier's tool the diamond must be uncut. Inferior kinds of diamonds are also extensively used by engineers in rock-boring, and by copper-plate engravers as etching-points. Diamonds are obtained from deposits of various kinds, mostly alluvial (sands, clays, &c.), being separated by washing. They have been found in India, Borneo, and other parts of the East; sometimes in N. America and Australia; Brazil has produced large numbers; but the chief diamond-field of to-day is in Cape Province, the centre being Kimberley. Diamonds were discovered here in 1807, and since then the output has amounted to over £183,000,000 in value. The diamonds are no longer obtained by mere surface workings, but the excavations have been carried down to a depth of 2000 feet. 'River diggings' are also carried on on the banks of some of the rivers. Some of the S. African diamonds are very large. One of them, the Cullinan diamond, discovered in 1905, is a monster of 3025 carats, of very good colour, being by far the largest diamond known. A celebrated diamond is the Koh-i-noor (Mountain of Light), an Indian stone belonging to the British crown. Its history extends over five or six centuries. It weighed at one time 280 carats, but by cutting has been reduced to about 100 carats. The Orlov diamond, which belonged to the Emperor of Russia, weighed 194 carats; the Pitt diamond, among the French crown jewels, weighs 136½ carats.—BIBLIOGRAPHY: A. Jeffries, *A Treatise on Diamonds and Pearls*; H. Emanuel, *Diamonds and Precious Stones*; E. W. Streeter, *Precious Stones and Gems*; *idem*, *The Great Diamonds of the World*; G. F. H. Smith, *Gem-Stones*; P. A. Wagner, *The Diamond Fields of Southern Africa*.

**Diamond-beetle**, *Entimus imperialis*, a handsome South American insect belonging to the family Curculionidae or weevils. It is spangled with golden-green on a black background.

**Diamond Harbour**, a port on the left bank of the Hugli River, about 38 miles by the railway from Calcutta, formerly much used as an anchorage for ships waiting for the tide.

**Diamond Lore.** In Hellenic, Arabian, Chinese, and other literature the diamond is connected with the eagle and snakes. Diamonds, according to ancient belief, lie in deep valleys infested by snakes, or entirely surrounded by straight, high cliffs. Pieces of flesh are thrown down and eagles seize them.\* The birds are followed to their nests, where the diamonds that adhered to the flesh are found. Mixed with this legend is the older one regarding the 'eagle stone', which assists parturition. It was believed a woman was easily delivered if the 'eagle stone' were placed on her abdomen. The Chinese legend was imported with the diamond from Fu-liu (Syria). Indian diamond lore is mixed with pearl lore. According to the Buddha birth stories, diamonds are found in the sea. The ancients asserted that the diamond could not be injured by iron, fire, or smoke. Before it could be broken it had to be steeped in ram's blood. The alchemists used lead as a substitute for ram's blood. In Chinese lore diamonds are rulers of gold and have their origin in gold. A similar belief prevailed in mediæval Europe, adamantine gold being credited with the same virtues as the diamond. Both gold and the diamond were sacred. The diamond is a mediæval symbol of Christ; in the Far East it is connected with Buddha. The association of the diamond with snakes gave origin to the belief that it was poisonous, the saliva of the snakes clinging to it. Diamond dust is regarded in India as a deadly poison. Like the sacred pearl, the diamond has been credited with nocturnal luminosity. Certain varieties of diamonds when heated, rubbed, or exposed in bright sunshine emit slight rays of light for a short time in darkness. The belief in 'night shining gems', however, had origin in pearl lore, the pearl having been connected with the moon ('the pearl of heaven'). Coral, rhinoceros-horn, fern seed, the mandrake, &c., were likewise connected with the moon-goddess and credited with nocturnal luminosity.

**Diamond Necklace**, an affair of some note in French history immediately preceding the Revolution. See *Marie Antoinette*; *La Motte*; and *Rohan, Louis*.

**Dian'a**, in Roman mythology, an ancient Italian goddess, in later times identified with the Greek Artëmis, with whom she had various attributes in common, being the virgin goddess of the moon, and of the chase, and having as attributes the crescent moon, bow, arrows, and quiver. The name is a feminine form of Janus. She seems to have been originally the patron divinity of the Sabines and Latins. She was worshipped especially by women, as presiding over births, no man being allowed to enter her temple.

# DIAMONDS



SOME OF THE WORLD'S FAMOUS DIAMONDS

1, Cullinan (uncut). 2, Cullinan No. 1. 3, Cullinan No. 2. 4, Koh-i-noor.  
5, Orlov. 6, Pitt. 7, Jubilee. All actual size.



**Diana-monkey** (*Cercopithecus Diana*), a species of monkey found in West Africa, and so named from the crescent-shaped band on the forehead resembling the crescent moon, which

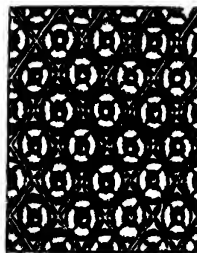


Diana. From a statue in the British Museum

was the symbol of Diana. Another characteristic feature is the possession of a pointed white beard.

**Diana of Poitiers**, Duchess of Valentinois, born in 1400. She was the mistress of King Henry II of France, and descended from the noble family of Poitiers, in Dauphiny. At an early age she married the Grand-Sénéchal of Normandy, Louis de Brézé, became a widow at thirty-one, and some time after the mistress of the young Duke of Orleans. On his accession to the throne in 1547, as Henry II, Diana continued to exercise an absolute empire over him till his death in 1559. After that event she retired to her castle of Anet, where she died in 1606.—Cf. Capellguy, *Diane de Poitiers*.

**Diapa'son**, in music, the concord of the first and last notes of an octave. The word is also used for the most important foundation-stops of an organ. They are of several kinds, as *open diapa'son*, *stopped diapa'son*, *double diapa'son*. The French use the term as equivalent to pitch in music.



Diaper Ornamentation. Westminster Abbey

**Di'aper**, a kind of textile fabric much used for towels and napkins, and formed either of linen or cotton, or a mixture of the two, upon the surface of which a flowered or figured pattern is produced by a peculiar mode of twilling.—As a term in ornamentation diaper is applied to a surface covered with a flowered pattern sculptured in low relief, or to a similar pattern in painting or gilding covering a panel or flat surface.

**Diaphanoscope**, (1) an apparatus by means of which transparent positive photographs may be viewed. The name is also given to (2) an instrument employed in obstetrical surgery; electric light, contained in a glass tube or bulb, is introduced into the female internal organs, and, thus illumined, their condition can be examined through the translucent walls of the abdomen.

**Diaphoret'ics** (Gr. *di*, run, to carry through) are agents used in medical practice to produce perspiration. They are employed in Turkish bath, hydropathic treatment, dilute acids, &c., are employed for this purpose. The degree of perspiration produced is more than normal, but less than in sweating. See *Sudorifics*.

**Diaphragm** (di'a-frum), in anatomy, a muscular membrane placed transversely in the trunk, and dividing the chest from the abdominal cavity. In its natural situation the diaphragm is convex on the upper side and concave on its lower, but when the lungs are filled with air it becomes almost flat. It is the principal agent in respiration, particularly in inspiration. A complete diaphragm is found only in Mammalia.

**Diarbek'ir**, a town in Armenia, formerly in Asiatic Turkey, capital of the vilayet of same name, on a high bank overlooking the Tigris, and surrounded by a lofty massive wall. It has manufactures of iron- and copper-ware, leather, silk, woollen, and cotton goods, and a considerable trade. Pop. about 38,000.—The province of Diarbekir has an area of 14,480 sq. miles, and a pop. of 471,500.

**Diarrhœa** is a morbidly frequent evacuation of the bowels. Several forms are recognized. *Choleraic diarrhœa*; this form is acute, and is marked by great frequency, with serous stools, and accompanied by vomiting and collapse. *Critical diarrhœa* occurs at the crisis of a disease. *Lienteric diarrhœa* is marked by the passage of fluid stools containing scraps of undigested food. *Mucous diarrhœa* is marked by the presence of mucous in the stools. *Summer diarrhœa* occurs chiefly among young children and infants, most frequently in late summer. It is usually acute in type and associated with marked prostration. In epidemic form it may give rise to a high mortality in crowded districts and in institu-

tions. *Nervous diarrhœa* is produced by some emotional cause. The treatment, whatever the type, is to get rid of the cause of the irritation, and to avoid further irritation in the intestinal tract. For this purpose purgatives are given, and all solid food forbidden. This is followed by gastro-intestinal sedatives and a gradual return to normal diet—substances causing least digestive difficulty being first given.

**Diastase** is an unorganized ferment or enzyme produced in the germination of barley, oats, &c. It is soluble in water, and the solution has the property of inducing fermentation or hydrolysis of starch into dextrine and glucose. To prepare diastase, barley is allowed to germinate; germination is then interrupted by raising the temperature, and the grain is treated with a mixture of water and alcohol under pressure, and filtered. Diastase, being soluble, is obtained in the filtrate.

**Diathermancy**, the property that is possessed in various degrees by different substances, of transmitting radiant heat. Bodies that are equally transparent, that is, bodies which have equal power of transmitting rays of light, are very different in their power of transmitting heat-rays. Thus a thin plate of glass and a thin plate of rock-salt may be nearly equally transparent, but the plate of rock-salt has far superior power of transmitting rays of heat. The latter, it has been found, allows 92 per cent of the total heat from most sources to pass; glass and other substances transmit a much smaller proportion, and the amount varies with the source. Rock-salt is diathermanous to heat from nearly all sources. It has been shown that rock-salt is extremely opaque or athermanous to the radiations from a piece of heated rock-salt. The diathermancy of the plates in every case decreases very rapidly as their thickness is increased. See *Radiation*.

**Diathesis** is the term given in medicine to a constitutional predisposition to a disease; thus uratic diathesis is a tendency to gout; aneurysmal diathesis is an inherent predisposition to aneurysms.

**Diatomaceæ**, a family of *Algæ*, consisting of microscopic unicellular plants with brown chromatophores found in fresh, brackish, and salt water, and on damp ground. The cell wall contains a very large quantity of silica, and is formed in each cell into three portions, viz. two generally symmetrical valves and a connecting hoop. The species consist of single free cells, or the cells remain connected so as to form usually linear colonies, sometimes enclosed in a transparent gelatinous sheath. The ordinary method of increase is by cell division. A sexual process resembling that of the conjugatæ also occurs. Diatoms constitute an important source

of food for the lower marine animals, and thus indirectly for the food-fishes. Diatomaceæ are found fossil, forming considerable deposits of tertiary age, as at Bilin, Richmond in the United States, &c. Fossil polishing-powders, as tripoli and bergmehl, are composed of them; also kieselguhr, which, impregnated with nitroglycerine, forms dynamite. They are abundant in guano.

**Diatomite** (Ger. *kieselguhr*), a diatomaceous earth (see *Diatomaceæ*) generally found underlying peat. In Skye, at Loch Quire, it is found about 18 inches below the surface, and extends downward for about 7 feet, and in some places to a much greater depth. Another important area is north of Toome Bridge in the county of Antrim. Diatomite is principally used for the manufacture of dynamite on account of its value as an absorbent. It is described also as extremely well adapted for the manufacture of silicate paints, siliceous glazings, porcelain, boiler-coatings, and for isolating felt and bricks for cold-storage buildings.

**Diatonic**, a term originally applied by the Greeks to one of their three genera of music. In modern music it is applied to the natural scale, and to the intervals, chords, melodies, or harmony characteristic of it. A diatonic chord is a chord having no note chromatically altered. A diatonic interval is an interval formed by two notes of the diatonic scale unaltered by accidentals. A diatonic melody is a melody composed of notes belonging to one scale only.

**Diaz**, Bartolommeo, a celebrated Portuguese navigator of the fifteenth century, named in 1486 commander of one of that long succession of exploratory expeditions which the Portuguese court had during this century become distinguished for promoting. The two vessels composing the expedition sailed along the African coast till they reached Cape Negro (lat. 15° 50' s.), where Diego Cam, a previous explorer, had stopped. At 20° s. they anchored at a point to which they gave the name of Angra das Voltas (Bay of Detours). In sailing south from this point they doubled the Cape of Good Hope without knowing it, and landed at a bay on the east coast. Diaz now wished to continue his voyage in order to discover the country of Prester John, but the sailors refused to accompany him. In again doubling the Cape he gave it the name of Cabo Tormentoso (Cape of Storms), which the king changed to its present designation. In 1500 Diaz had command of a vessel in the expedition of Cabral which discovered Brazil. In returning home the vessel which he commanded was lost, 20th May, 1500.

**Diazo Compounds**, or **Diazonium Com-**

pounds, a name given to substances containing the chemical group  $-N:N-$ ; thus diazo-benzene chloride,  $C_6H_5-N:N\cdot Cl$ , or diazo-toluene sulphate,  $C_6H_4(CH_3)-N:N\cdot HSO_4$ , &c.

These substances are formed from the aromatic amines by treatment with nitrous acid at low temperatures. Primary amines all react with nitrous acid at moderate temperatures when the amino group ( $NH_2$ ) is replaced by a hydroxyl group ( $OH$ ); thus ethylamine ( $C_2H_5NH_2$ ) reacts with nitrous acid ( $HNO_2$ ), yielding alcohol ( $C_2H_5OH$ ),  $C_2H_5NH_2 + HNO_2 = C_2H_5OH + N_2 + H_2O$ . The aromatic amines, however, if treated below  $0^\circ C$ . with nitrous acid, yield diazo compounds, and not hydroxy compounds, e.g. aniline treated with nitrous acid in hydrochloric acid solution yields diazo-benzene chloride,  $C_6H_5NH_2\cdot HCl + MONO = C_6H_5-N:N\cdot Cl + 2H_2O$ . Diazo salts are crystalline compounds soluble in water, sparingly soluble in alcohol, and are unstable, decomposing explosively if struck or suddenly heated. In solution in water they decompose as the temperature rises, liberating nitrogen, and forming hydroxy compounds,  $C_6H_5N:N\cdot Cl + H_2O = C_6H_5OH + N_2 + HCl$ . Diazo salts are valuable in the synthesis of different classes of compounds, as the  $-N:N-$  group reacts readily with other groups. For this purpose it is usually only necessary to prepare a solution containing the diazo compound. In the preparation of the azo dyes the starting-point is a primary amine; the amino group is 'diazotized', i.e. treated with a solution of sodium nitrite and dilute mineral acid at low temperature. A diazo salt is formed, and is then made to react in solution with a hydroxy compound or an amino compound, &c., with the formation of a highly coloured azo compound. The diazo compound is then said to be coupled. Diazo compounds are therefore important intermediate substances in the manufacture of azo dyes.

The diazo group may also be exchanged for the hydroxyl group by warming the solution with water, or for the cyanogen group by warming with a solution of potassium cyanide, e.g. diazo-benzene chloride warmed with potassium cyanide solution is converted into the nitrile of benzoic acid,  $C_6H_5-N:N\cdot Cl + KCN = C_6H_5CN + KCl + N_2$ ; or transformed into halogen derivatives of hydrocarbons by warming with cuprous chloride, e.g. diazo-benzene chloride is transformed into chlorobenzene,  $C_6H_5-N:N\cdot Cl + Cu_2Cl_2 = C_6H_5Cl + N_2 + Cu_2Cl_2$ . These reactions, where nitrogen is eliminated from the compound, and a group or element replaces the two atoms of nitrogen, afford a means of synthesizing a variety of compounds.

Dib'din, Charles, an English dramatic manager and poet, composer and actor, born in 1745, died in 1814. At the age of fifteen he made his

appearance on the stage, and was early distinguished as a composer. He invented a new kind of entertainment, consisting of music, songs, and public declamations, which he wrote, sang, composed, and performed himself, and by this means succeeded in amusing the public for twenty years. In 1769 he composed some of the music for the Shakespeare jubilee at Stratford-on-Avon. His patriotic songs were very popular, and his sea-songs, amongst which are *Tom Bowling*, *Poor Jack*, and *The Trim-built Wherry*, are still favourites in the British navy. He also wrote a *History of the Stage*, and the novels *The Devil* and *Hannah Hewitt*.—His son, Charles Dibdin, composed and wrote many small pieces and occasional songs.—Another son, Thomas, early displayed the same dramatic tastes as his father, was connected with various theatres, and wrote a great many songs and a number of dramas.

Dibdin, Thomas Frognall, an English bibliographer, born in 1776, died in 1847, was the son of the elder brother of Charles Dibdin the celebrated naval song-writer. After studying law and practising as a provincial counsel, he took orders and became a popular preacher in London. Here his bibliographical tastes developed themselves, and the Roxburghe Club being established in 1812, he became its first vice-president. Among his numerous writings may be noted: *Bibliomania*, *Bibliographical Decameron*, *Typographical Antiquities of Great Britain*, and *The Library Companion*.

Dibranchia'ta. See *Cephalopoda*.

Dice, cubical pieces of bone or ivory, marked with dots on each of their six faces, from one to six, according to the number of faces. They are shaken in a small box and then thrown on the table. Dice are often loaded or falsified in some way so as to make the high or the low sides turn down. The origin of dice is ascribed to Palamedes of Greece (1244 B.C.), although Herodotus attributes the invention of knuckle-bones and of dice to the Lydians. Dice were well known amongst the ancient Egyptians and Greeks, and are still very popular in Japan, China, India, and other Asiatic countries.

Dicen'tra. See *Diphytra*.

Dichasium. See *Cyme*.

Dichlamydeous (di-klam-id'i-us), in botany, said of plants that have both calyx and corolla.

Dichogamy, in flowers, the condition in which anthers and stigmas ripen at different times, whereby self-pollination is effectually prevented. If the anthers ripen first, as in borage, columbine, crocus, Caryophyllaceæ, Compositæ, Labiatæ, &c., the flower is said to be protandrous; protogynous flowers, with stigmas ripening and withering before the pollen is shed, occur, e.g. in Christmas rose, Colchicum,



horse-chestnut, and in the majority of wind-pollinated plants.

**Dichotomy** (di-kot'o-mi), a cutting in two; a division by pairs. Hence, in botany, a mode of branching by constant forking, each branch dividing into two others. See *Branching*.

**Dichroic**, or more generally **Pleochroic**, **Crystals** (di-kro'ik), crystals that have the property of exhibiting different colours, according to the direction in which they are traversed by rays of light. When polarized light is passed through a transparent plate of a pleochroic mineral, the colour will vary with the direction in which the light-vibrations take place. Hence, *face-pleochroism*, the colour of the plate, may be distinguished from the colours given by *axis-pleochroism*, the colours given by light vibrating parallel with certain optical directions in the crystal.

**Dichroite** (di'kro-it), or **Iolite**, a mineral, a silicate of magnesium, iron, and aluminium, which readily undergoes modifications and passes into hydrous silicate. It exhibits marked pleochroism, whence the name.

**Dick**, Thomas, LL.D., a Scottish author of popular scientific works, born at Dundee in 1774, died 20th July, 1857. He was for many years a teacher at Perth, but subsequently resided at Broughty-Ferry, where he devoted himself to astronomical science, especially in its relations to religion. Some years before his death a small pension was granted to him by the Government. Amongst his works are: *The Christian Philosopher* (1823), *The Philosophy of Religion* (1825), *The Philosophy of a Future State* (1828), and *Celestial Scenery* (1838).

**Dickens**, Charles, one of the greatest English novelists, born 7th Feb., 1812, at Landport, Portsmouth, died 9th June, 1870. His father, John Dickens, was then in the employment of the Navy Pay Department, but subsequently became a newspaper reporter in London. Young Dickens received a somewhat scanty education, was for a time a mere drudge in a blacking warehouse, and subsequently a clerk in an attorney's office. Having perfected himself in shorthand, however, he became a newspaper critic and reporter, was engaged on *The Mirror of Parliament* and *The True Sun*, and in 1835 on *The Morning Chronicle*. For some time previously he had been contributing humorous pieces to *The Monthly Magazine*; but at length, in 1835, appeared in *The Morning Chronicle* the first of that series of *Sketches by Boz* which brought Dickens into fame. It was followed in quick succession by a pamphlet entitled *Sunday under Three Heads*, by Timothy Spark (1836); *The Tugs at Ramsgate* (1836); *The Village Coquette*, a comic opera (1836); and a farce called *The Strange Gentleman* (1836). In

the same year Chapman & Hall engaged the new writer to prepare the letterpress for a series of comic sketches on sporting subjects by Seymour, an artist who had already achieved fame, and suggested as a subject the adventures of an eccentric club. Seymour committed suicide soon after, and H. K. Brown, joined Dickens as illustrator, the result being the immortal *Pickwick Papers*. The great characteristics of Dickens's genius were now fully apparent, and his fame rose at once to the highest point it was possible for a writer of fiction to reach. A new class of characters, eccentric indeed, but vital representations of the humours and oddities of life, such as Mr. Pickwick, Sam Weller and his father, Mr. Winkle, and others, was made familiar to the public. Under the name of *The Posthumous Papers of the Pickwick Club* this work was published in 2 vols. 8vo, in 1837. In the same year Dickens was engaged as editor of *Bentley's Magazine*, to which he contributed *Oliver Twist*, a work which opened up that vein of philanthropic pathos and indignant satire upon institutions which became a distinguishing feature of his works. Before the completion of *Oliver Twist*, *Nicholas Nickleby* was begun, being issued complete in 1839. As the special object of *Oliver Twist* was to expose the conduct of workhouses, that of *Nicholas Nickleby* was to denounce the management of cheap boarding-schools. *Master Humphrey's Clock*, issued in weekly numbers, contained among other matter two other leading tales, *The Old Curiosity Shop* and *Barnaby Rudge*, the latter a historical tale, going back to the times of the Gordon riots. It was published complete between 1840 and 1841. In 1841 Dickens visited America, and on his return he wrote *American Notes for General Circulation* (1842). His next novel, *Martin Chuzzlewit* (1844), dwelt again on his American experiences. This work also added a number of typical figures—Mr. Pecksniff, Mark Tapley, Sarah Gamp, and others—to English literature. The series of *Christmas Tales*, in which a new element of his genius, the power of handling the weird machinery of ghostly legend in subordination to his own peculiar humour, excited a new sensation of wonder and delight. These, enumerated consecutively, were: *A Christmas Carol* (1843), *The Chimes* (1844), *The Cricket on the Hearth* (1845), *The Battle of Life* (1846), *The Haunted Man and The Ghost's Bargain* (1847). The extraordinary popularity of these tales created for a time a new department in literature, that of the sensational tale for the Christmas season. In 1845 Dickens went to Italy, and on his return *The Daily News*, started on 1st Jan., 1846, was entrusted to his editorial management; but, despite his early training, this was an occu-

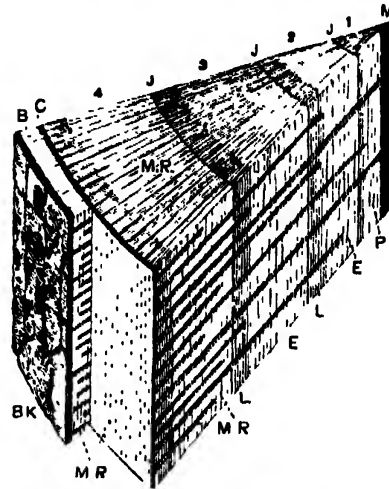
pation uncongenial to his mind, and in a few months the experiment was abandoned. His *Pictures from Italy* were published the same year. Next followed his novel of *Dombey and Son* (1848), and *David Copperfield*, a work which has a strong autobiographical element in it (1849-50). In 1850 Dickens became editor of the weekly serial *Household Words*, in which various original contributions from his own pen appeared. In 1853 his *Bleak House* came out. *A Child's History of England*, commenced in *Household Words*, was published between 1852 and 1854. *Hard Times* appeared in *Household Words*, and was published in 1854. *Little Dorrit*, commenced in 1856, dealt with imprisonment for debt, the contrasts of character developed by wealth and poverty, and executive imbecility, idealized in the Circumlocution Office. In 1859, in consequence of a disagreement with his publishers, *All the Year Round* superseded *Household Words*; and in the first number of this periodical, 28th May, was begun *A Tale of Two Cities*. *Great Expectations* followed in the same paper, on 1st Dec., 1860. In *All the Year Round* also appeared a series of disconnected sketches called *The Uncommercial Traveller*, published in 1868. *Our Mutual Friend*, completed in 1865, and published in the usual monthly numbers, with illustrations by Marcus Stone, was the last great serial work which Dickens lived to finish. It contained some studies of characters of a breadth and depth unusual with Dickens, and is distinguished among his works by its elaborate plot. The first number of his last work, *The Mystery of Edwin Drood*, was issued on 1st April, 1870, and only three numbers had appeared when he died somewhat suddenly, at his residence, Gad's Hill Place, near Rochester, on 9th June. He had considerably overtaxed his strength during his later years, more especially by his successive series of public readings from his own works, one series being delivered in America between 1867 and 1868. He was buried in Westminster Abbey. Dickens's work as a novelist is firmly based upon a wide and keen observation of men. The essence of his art was caricature, and for comic effect he, therefore, often exaggerated the abuses he attacked. His characters exhibit little more than one trait or quality, but the single trait or quality which they embody is truly conceived, and exhibited with great vitality and humour. His creative power was immense, and his great humour is admitted by all, even by those who consider his pathos as overdrawn. In spite, therefore, of all that is grotesque and overstrained in his work, he has been rightly placed amongst the great artists.

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*Critical Study*; G. K. Chesterton, *Charles Dickens*; R. H. Shepherd, *The Bibliography of Dickens*; Sir F. T. Marzials, *Life of Charles Dickens*; E. Pugh, *The Charles Dickens Originals*; P. H. Fitzgerald, *Memoirs of Charles Dickens*.

**Dicksonia**, a genus of Leptosporangiate ferns, section Gradate, mostly large tree-ferns, such as *D. antarctica*, a native of Australia and New Zealand, often grown in greenhouses.

**Dicotyledon** (di-kot-i-lē'don), a plant whose seeds are readily recognized by the embryo containing a pair of cotyledons or seed-leaves,



Portion of a Four-year-old Dicotyledonous Woody Stem cut in Winter

B, Bast. B.K., Bark external to the first periderm layer, corresponding to the primary cortex. C, Cambium ring. E, Early wood. J, J, J, Junction of the wood of successive years. L, Late wood. M, Medulla. M.R., Medullary rays, various views. P, Protoxylem. 1, 2, 3, 4, The four successive annual rings.

which are always opposite to each other. Dicotyledons are further characterized by their netted-veined leaves and their 'open' vascular bundles containing a cambium; the parts of the flower are commonly in fours or fives. In Bentham and Hooker's system the class is divided into four subclasses—Thalamifloræ, Calycifloræ, Corollifloræ, and Monochlamydeæ. Engler's system recognizes only two subclasses, viz. Archichlamydeæ and Sympetaleæ.

**Dictaphone**, an adaptation of the gramophone, in which the principle of that invention is applied to the requirements of modern business. Letters or memoranda are spoken into the machine, which 'records' them on waxen cylinders. The machine is then passed on to a shorthand writer or typist (or the cylinder may be transferred to a duplicate machine), and the recorded matter is dictated. The

motive power is electricity; the speed of dictation is capable of adjustment to that of the writer; and by means of an accessory machine the records can be scraped and re-used.

Dictator, an extraordinary magistrate of the Roman Republic, first instituted B.C. 501. The power of naming a dictator, when an emergency arose requiring a concentration of the powers of the State in a single superior officer, was vested by a resolution of the Senate in one of the Consuls. The dictatorship was limited to six months, and the person who held it could not go out of Italy. This rule was laid aside during the first Punic War. The dictator was also forbidden to appear in Rome on horseback without the permission of the people, and he had no control over the public funds without the permission of the Senate. He had the power of life and death, and could punish without appeal to the Senate or people. All the other magistrates were under his orders. Originally the dictator was a patrician, but in 356 B.C. the plebeian Marcus Rutilius was called upon to fill the office of dictator. The term is now often applied to rulers enjoying or exercising extra-constitutional power.—Cf. A. H. J. Greenidge, *Roman Public Life*.

\* Dictionary (from the Lat., *dictio*, a saying, expression, word), a book containing the words, or subjects, which it treats, arranged in alphabetical order. It may be either a vocabulary, or collection of the words in a language, with their definitions; or a special work on one or more branches of science or art prepared on the principle of alphabetical arrangement, such as dictionaries of biography, law, music, medicine, history, or philosophy. Amongst dictionaries of the English language, the earliest seem to have been those of Bullokar (1616) and Cockeram (1623). That of Dr. Johnson, published in 1755, made an epoch in this department of literature. Previous to this the chief English dictionary was that of Bailey, a useful work in its way. An enlarged edition of Johnson's dictionary, by the Rev. H. J. Todd, appeared in 1818; and this, again enlarged and modified, was issued under the editorship of Dr. R. G. Latham (1864-72). The best-known American dictionary of the English language is that by Noah Webster, published in 1828, and since entirely recast. Richardson's dictionary, published during 1830 and 1837, was valuable chiefly for its quotations. Ogilvie's *Imperial English Dictionary*, based on Webster, and first published between 1847 and 1850, has been issued in a remodelled and greatly enlarged form (4 vols. 1881-2 and subsequently, Charles Annandale, LL.D., editor). It is one of the encyclopædic dictionaries. Cassell's *Encyclopædic Dictionary* is another extensive work (1879-88). The largest completed English dic-

tionary is the *Century Dictionary* (New York, 1889-91, 6 vols. quarto). *The Standard Dictionary* is another American work. A new English dictionary 'on historical principles', first edited by Sir J. A. H. Murray, LL.D., with the assistance of many scholars, and now edited by Dr. Henry Bradley, is being published at the Clarendon Press since 1884. Among foreign dictionaries are the polyglot dictionary of Calepino (1502), the Latin and Greek *Thesaurus* of Robert and Henry Stephanus, the Italian *Vocabulario della Crusca* (1612), &c. The chief etymological dictionary of English words is that by Professor Skeat (1882). Among French dictionaries (for French people) the chief is that of Littré; among German, the dictionary begun by the brothers Grimm.

*Dictyotaceæ*, a family of Brown Algae, section Cyclosporeæ. *Dictyota dichotoma*, with a delicate, flattened, repeatedly forked thallus, is not uncommon in sandy pools on our coasts. The plants are of three kinds, viz. ♂, bearing antheridia; ♀, bearing oogonia; and neuter, producing tetraspores. The oospores give rise to neuter plants, the tetraspores to ♂ or ♀ plants. This is one of the best instances of 'homologous' alternation of generations, i.e. that type in which the different generations are identical in form, differing only in their reproductive organs and in the number of chromosomes in their nuclei. Another genus is *Padina*.

*Didactic Poetry*, that kind of poetry which professes to give a kind of systematized instruction on a definite subject or range of subjects. Thus the *Georgics* of Virgil and the *De Rerum Natura* of Lucretius profess to give, the one a complete account of agriculture and kindred arts, the other a philosophical explanation of the world. Other examples of purely didactic poetry are Horace's *Ars Poetica*, and Pope's *Essay on Criticism*. In a larger sense of the word most great poems might be called didactic, since they contain a didactic element in the shape of history or moral teaching, Dante's *Divina Commedia*, Milton's *Paradise Lost*, or Goethe's *Faust*, for example. The difference may be said to be this, that in the one case the materials are limited and controlled by nothing but the creative fancy of the poet, while in the other they are much more determined by the actual nature of the subject treated of.

*Didel'phia*, one of the three subclasses of the Mammalia (the others being Monodelphia and Ornithodelphia), comprising only one order, that of Marsupials or pouched mammals.

*Diderot* (dêd-rô), Denis, a French writer and philosopher, born in 1713, at Langres, in Champagne, died in 1784. He was educated in the

school of the Jesuits, and afterwards at Paris, at the College of Harcourt, but declined to study law, preferring to earn his living by teaching mathematics. His first works were the *Essai sur le Mérite et la Vertu* (1745); and the *Pensées Philosophiques* (1746), a pamphlet against the Christian religion. His *Lettre sur les Aveugles à l'Usage de Ceux qui Voyent* is in the same strain. These heterodox publications cost him an imprisonment for some time at Vincennes. Diderot now tried writing for the stage, but his pieces were failures. In 1749 he had begun, along with D'Alembert and some others, the *Encyclopædia*. At first it was intended to be mainly a translation of one already published in English by Chambers. Diderot and D'Alembert, however, enlarged upon this project, and made the new *Encyclopædia* a magnificently comprehensive and bold account of all the thought and science of the time. Diderot, besides revising the whole, undertook at first the mechanical arts, and subsequently made contributions in history, philosophy, and art criticism. But the profits of all his labour were small, and it was only the liberality of the Empress Catherine, who purchased his library for 50,000 livres and made him a yearly allowance of 1000 livres, that saved Diderot from indigence. In 1773 he visited St. Petersburg to thank his benefactress and was received with great honour. On his return to France he lived in retirement, passing the last ten years of his life in writing and conversations, wherein, as Marmontel said, he was at his best. Besides his articles in the *Encyclopædia* he wrote numerous works, some of which were published after his death. Among the best known are *Le Neveu de Rameau*, a kind of philosophical dialogue which Goethe thought worthy of translation; *Essai sur la Peinture*, and *Paradoxe sur le Comédien*, suggestive essays on the principles of painting and acting; two lively tales, *La Religieuse* and *Jacques le Fataliste*. On account of his great interest in almost every branch of human knowledge, Voltaire nicknamed him 'Pantophile Diderot'.—BIBLIOGRAPHY: T. Carlyle, *Essay on Diderot*; F. Brunetière, *Études Critiques*; R. L. Cru, *Diderot as a Disciple of English Thought*.

Dido, or Elissa, the reputed founder of Carthage. She was the daughter of a king of Tyre, called by some Belus, by others Metten or Matgenus. After her father's death, her brother Pygmalion murdered her husband Siharbas, or as Virgil calls him Sychæus, with the view of obtaining his wealth. But Dido, accompanied by many Tyrians of her party, fled with all the treasure over sea, and, landing on the coast of Africa, founded Carthage about 800 B.C. The story is told by Virgil, with many

inventions of his own, in the *Æneid* (Books I and II).

Didot (dê-dō), a famous house of printers, booksellers, and typefounders at Paris. The founder was François Didot, born in 1689, died 1757. Of his sons François-Ambroise (born 1720, died 1804) and Pierre-François (born 1732, died 1795) the first distinguished himself in the type-founding art as an inventor of new processes and machines, the second was equally eminent for his bibliographical knowledge, and contributed much also to the advancement of printing.—Pierre (born 1761, died 1858) succeeded his father François-Ambroise in the printing business. He made himself famous by his magnificent editions of classic authors in folio, amongst which his Virgil (1798) and his Racine (1801) may be particularly mentioned. He did much also for the improvement of types. He is known also as an author.—Firmin (born 1764, died 1836), the brother of Pierre, took charge of the type-founding, was the inventor of a new sort of script, and an improver of the stereotype process.—Ambroise-Firmin (born 1790, died 1876), and Hyacinthe-Firmin (born 1794, died 1880) occupied a distinguished position amongst the publishers of Paris. The former left a collection of MSS. which was worth, at the time of his death, about two million francs. The house has now extended its trade into everything connected with bookselling, paper-making, and book-binding.

Didsbury, a district of Manchester, on the Midland Railway, 4 miles south by east of Manchester, a place of residence of many Manchester business men. There is an important Wesleyan Training College there. Pop. 9234.

Didun'culus, a genus of birds allied to the pigeons, and comprising only the one species,



*Didunculus strigirostris*

*D. strigirostris*, native to some of the Samoan Islands. This bird is of special interest as being the nearest living ally of the extinct dodo. It has a length of about 14 inches, with a glossy plumage verging from a velvety black on the back to greenish black on the head, breast, and abdomen. The large beak, which is nearly as

long as the head, is greatly arched on the upper half, while the lower is furnished with two or three tooth-like indentations.

**Didymium**, a rare metallic element, occurring along with *lanthanum* in the mineral cerite as discovered by Mosander in 1842. It has been resolved into two new elements: *Praseodymium* (Pr, 140.9) and *Neodymium* (Nd, 144.3).

**Die**, a metallic stamp for impressing a design or figure upon coins or other metallic objects. See *Dies* and *Die-sinking*.

**Die** (dē), an ancient town, France, department of Drôme, 26 miles south-east of Valence; site of an ancient cathedral and Roman remains. Pop. 4000.

**Dié** (di-ā), St., a town, France, department of Vosges, on the Meurthe, 25 miles E.N.E. of Epinal. Both iron and copper are worked; there are marble quarries; and numerous manufactures are carried on. Pop. 19,029.

**Diebitsch-Sabalkanski**, Hans Karl, a Russian general, born at Grossclippe, in Silesia, in 1785, died 9th June, 1831. He was educated at the military school of Berlin, but in 1801 quitted the Prussian service for that of Russia. He was present at the battles of Austerlitz and Friedland, served with distinction in the campaign of 1812, took part in the battles of Dresden and Leipzig, and was made lieutenant-general at the age of twenty-eight. He had the chief command in the Turkish War of 1828-9, stormed Varna, and made the famous passage of the Balkans, for which the surname of Sabalkanski was conferred on him. In 1830 he commanded the army sent against the revolted Poles, but did not distinguish himself in this service.—Cf. Bantych-Kamenski, *Biographies of Russian Field-marshal*s.

**Dieffenbach** (dē'fen-bāk), Johann Friedrich, German surgeon, born at Königsberg in 1792, died in 1847. After having studied at Bonn and Paris, he settled in Berlin, where his talent as an operator soon attracted notice. Surgery is particularly indebted to him for new methods of forming artificial noses, eyelids, and lips, and curing squinting and stammering.

**Diego Garcia**. See *Chagos*.

**Dielectric**, in electricity, a name applied by Faraday to any medium through or across which electrostatic induction can take place. See *Electricity* (Electrostatics). Faraday first showed that electrostatic induction was not action at a distance, but took place by means of the insulating medium separating the two conductors. The medium he named a *dielectric*, and measured its specific inductive capacity by taking that of common air as unity.

**Dielytra**, or *Dicentra*, a genus of plants, of the nat. ord. Fumariaceæ or Fumitories. The best known is *D. spectabilis*, a native of Northern

China and Siberia, now common in European and other gardens. It blossoms in April and May, and its long drooping racemes of purplish-red blossoms present a very graceful appearance. It grows freely in the open air. It is sometimes called bleeding heart or virgin's heart from the shape of the blossoms.

**Diemen** (dē'men), Anton van, Dutch administrator, was born in 1598, died in 1645. Having gone to India, he speedily rose to the highest dignities, and was at length, in 1636, made Governor-General. He administered the government with much ability, and contributed much to the establishment of the Dutch commerce in India. Abel Tasman, whom he sent with a vessel to the South Seas in 1642, gave the name of *Van Diemen's Land* to the island now called Tasmania.

**Dieppe** (dē-ep'), a seaport town, France, department of Seine-Inférieure, on the English Channel, at the embouchure of the Arques, 93 miles N.W. of Paris. Almost the only public edifices worth special notice are the two Gothic churches, St. Jacques, begun in the thirteenth century, and St. Rémi, founded in 1522, and the old castle (1433), now a barracks. To the west of Dieppe proper is the suburb La Barre; and on the opposite side of the harbour Le Pollet, inhabited chiefly by sailors and fishermen. The old port is spacious, but a new channel with its own harbour system has been added, and vessels of 20-foot draft can now enter. Dieppe is one of the chief watering-places of France, and is much frequented by visitors in summer and autumn. The great bathing establishment forms a luxurious retreat for bathers and invalids, and includes a ballroom. The manufactures include works in ivory, horn, and bone, lace-making, sugar-refining, and shipbuilding. There is a busy fishery, and the foreign trade is still considerable. There is constant steam intercourse between this port and New-haven. In early times Dieppe was the chief port of France, but its prosperity diminished after the revocation of the Edict of Nantes (1685). During the European War Dieppe was an important Allied base. Pop. 23,973.

**Dierx**, Léon, French poet, born in the Island of Réunion in 1838. Educated in Paris, he became one of the foremost of the Parnassians. His works include: *Aspirations*, *Poèmes et Poésies*, *La rencontre*, and *Les Amants*. His collected poems (1889-90) were crowned by the Académie. He died in Paris, 11th June, 1912.

**Dies** and **Die-sinking**. *Die-sinking* is the art of preparing dies, a die being a plate or block, usually of metal, so cut or shaped as to be capable, by means of stamping or pressure, of transferring a given design to some article which is to be manufactured in quantity. The

pressure may be applied by any sort of power, from hand to hydraulic.

- The steel for the manufacture of steel dies is carefully selected, forged at a high heat into the rough die, softened by careful annealing, and then handed over to the engraver. After the engraver has worked out the design in intaglio, the die is put through the operation of hardening, after which, being cleaned and polished, it is called a *matrix*. This is not, however, generally employed in multiplying impressions, but is used for making a *punch* or steel impression for relief. For this purpose another block of steel of the same quality is selected, and, being carefully annealed or softened, is compressed by proper machinery upon the matrix till it receives the impression. When this process is complete, the impression is retouched by the engraver, and hardened and collared like the matrix. Any number of dies may now be made from this punch by impressing upon it plugs of soft steel.

There is hardly any article which does not in the course of its manufacture require the use of a die of some kind. For all sorts of metal-work, seals, rings, silverware, moulds and shapes of sheet steel or tin, dies are employed. For this class of work they are usually of steel. For embossing articles of leather, wood, celluloid, rubber, cloth, or clay, dies of brass and phosphor-bronze are commonly used, these being easier media to work in and yet sufficiently strong. The dies for letter headings and company seals are cut, in reverse to the design required, in steel; those for sealing-wax seals in steel or brass; the lettering being usually punched in by hand by separate letter punches, which themselves have been cut in relief on steel. Designs which are unusually ornate may be engraved by hand. Dies for embossing designs on leather, catalogue covers, cardboard articles, cards, and soft materials are usually modelled in brass. The design in reverse is cut out to a depth corresponding to the relief wanted. These dies are usually worked up by hand by the engraver. Dies for the reproduction of rubber stamps for printing on clay are cut in phosphor-bronze or hard brass in relief and reverse, and with an extreme bevel. The dies or blocks are then struck deeply into lead, and melted rubber is poured into the moulds so formed. When set, the rubber is removed and mounted as a hand-stamp ready to impress the clay in ink. Dies for wall-papers are cut on rollers. Steel dies for flower-shapes have a cutting edge, so that they can stamp out and emboss in one action. Of late years machinery has come much into use for relieving the engraver of some of his labour, but the designs are generally kept secret. One machine, called the pantograph or engraving machine, reproduces engravings in all metals

and many shapes from patterns. Many of the stamp-duty steel dies made and issued by the Royal Mint are reproduced from this machine in reductions from brass patterns.—BIBLIOGRAPHY: Lucas, *Dies and Die-making*; J. V. Woodworth, *Dies: their Construction and Use*.

Diesel, Rudolph, German inventor, born in Paris in 1858, died in 1913. Educated in England, and at Munich, he proposed in 1893 to utilize directly the energy created by the combustion of fuel, a proposal which led to his invention of the Diesel engine. (See *Internal Combustion Engines*.) In 1913 he was called to England to consult with the Admiralty on the application of his motor, but was drowned in crossing the Channel. In 1894 he published a monograph entitled *Theory and Construction of a Rational Heat Motor*.

*Dies Fasti et Nefasti*, a Roman division of days, with reference to judicial business, into working-days and holidays. A *dies fastus* was a day on which courts and assemblies could be held and judgments pronounced; a *dies nefastus*, a day on which courts could not be held nor judgments pronounced.

*Dies Iræ* (dî'es l'rê), one of the great Latin hymns of the Mediæval Church, generally used as part of the requiem or mass for the souls of the dead. It describes, as its name ('the day of wrath') denotes, the Last Judgment of the world, and seems to have been suggested by the description in *Zephaniah*, i, 15 and 16. It is supposed to have been written by Thomas da Celano, a Franciscan friar of the thirteenth century. It was translated by Crashaw and Dryden in the seventeenth century, and by Macaulay and others in the nineteenth, but none of these translations conveys the solemn force of the original.

*Diest* (dêst), a town, Belgium, province of Brabant, 32 miles E.N.E. of Brussels. It has some manufactures, but the chief products of the place are beer and gin, the former being largely exported. The town was occupied by the Germans in 1914, and re-entered by the Belgians in 1918. Pop. 8800.

*Diesterweg*, Friedrich Adolf Wilhelm, German educator, born in 1790, died in 1866. In 1820 he became director of the new Teachers' Seminary at Mörs, and soon gained a reputation as teacher and educator. He was a follower of Pestalozzi, and aimed at making every subject of instruction a means of education. In 1827 he founded the *Rheinische Blätter für Erziehung und Unterricht*, wherein he advocated his pedagogical views.

*Dî'et*, a meeting of some body of men held for deliberation or other purposes; a term especially applied to the legislative or administrative assemblies of Austria, Germany, and Poland.

*Dietet'ics* (Gr. *diata*, daily regimen), that



part of medicine which relates to the regulation of diet. The ideal diet is clearly that which, without burdening the viscera uselessly, furnishes all necessary nutritive elements, with due consideration for special physiological conditions in any given case. Under the head of *Aliment* the physiological properties of various foods have already been considered theoretically in respect of their capacity to supply physical waste in nitrogenous and non-nitrogenous matter. (*Aliment*.) No single substance contains the elements needed to replace this waste in their requisite proportions, and a mixed diet is therefore necessary. For instance, to secure the required amount of carbon a man would need to eat about 4 lb. of lean beef, while 1 lb. would yield all the nitrogen required; thus, apart from the labour of digesting 4 lb. of beef, the body would be compelled to get rid of the excess of nitrogen. Bread, on the other hand, has carbon in abundance, but is deficient in nitrogen; so that by uniting 2 lb. of bread with  $\frac{1}{2}$  lb. of lean meat, the due proportion of carbon and nitrogen is satisfactorily supplied. Milk and oatmeal taken together also contain nitrogenous and non-nitrogenous substances in nearly the required proportions. A certain proportion of saline matter is also necessary. The nature of the food most suitable for a healthy man is dependent in part upon general conditions, such as climate and season, and in part upon special conditions of individual habit. The inhabitants of the Arctic regions need large quantities of oleaginous food; those of the Tropics live chiefly on starchy products. With increased activity and exertion, as in training, an increase in the nitrogenous foods becomes necessary. In a state of health we need not draw hairbreadth distinctions as to the superior salubrity of the several sorts of diet, the quantity rather than the quality of food being the main consideration. Those persons who have been most remarkable for health and long life have generally been contented with two moderate meals a day, which are certainly quite sufficient during a state of health. In various countries the breakfast generally consists of tea, coffee, or cocoa, with a certain proportion of bread and butter; persons with delicate digestive powers, or who lead a sedentary life, cannot with safety or comfort eat animal food *constantly* to breakfast. At dinner all made-dishes highly spiced, such as curries, turtle-soup, &c., as provoking appetite, are hurtful; and the custom of late dining is not to be commended. Stewed and boiled meats are more difficult to digest than meat cooked by fire alone. The flesh of young animals seems to be more difficult of digestion than that of old; and the flesh of tame than that of wild animals. All sorts of fat meat must be taken in

smaller quantities. Hence, also, ham, bacon, and salted meats cannot be eaten in such quantities as the tender flesh of poultry. Fish has the advantage of being easily soluble. All boiled vegetables are in general easy of digestion; raw vegetables and salads are rather more difficult. Fruit should be taken in the forenoon rather than after a hearty meal. The moderate use of fermented liquors is far from being invariably an evil, but the smaller the quantity habitually used the better in the majority of cases.

In all diseases attended with much fever or quickness of pulse the stomach loathes animal food, and there is generally a great increase of thirst, to quench which water, either quite cold, or iced, or tepid, or rendered acid, may be freely indulged. Infusions, too, of barley, sage, balm, &c., may be taken. In chronic diseases attended with hectic fever, milk is the most proper diet. The best food for infants is, of course, their mother's milk; but whenever they begin to cut teeth a little animal food, such as soft-boiled eggs, beef-tea, and even chicken minced very fine, may be given. Many infants suffer from having too much sugar given them in their food.—BIBLIOGRAPHY: R. H. Chittenden, *Physiological Economy in Nutrition*, and *Nutrition of Man*; Hutchison, *Food and Dietetics*; Lusk, *The Science of Nutrition*.

Dietrich (dē'trik), Christian Wilhelm Ernst, a German painter and engraver, born in 1712, died in 1774. He studied under his father, and afterwards under Alexander Thiele at Dresden, where he became court-painter and professor in the academy. He adopted several different manners, successfully imitating Raphael and Mieris, Correggio, and Ostade.

Dietrich of Bern (dē'trik), the name under which Theodoric the Great, King of the Ostrogoths, appears in the old German legends. Bern stands for Verona, his capital.

Dieu, or D'Yeu (dyeu; ancient *Insula Dei*), an island off the west coast of France, department of Vendée. It is inaccessible on the west side, but on the east has a tolerable harbour defended by batteries. The chief industry is fishing. There are four lighthouses on the island. Pop. 3809.

Dieu et Mon Droit (dyeu e mon drwa; 'God and my right'), the battle-cry of Richard I at the battle of Gisors (1198), signifying that he was not subject to France, but owed his power to God alone. The battle-cry was then adopted as the motto of the arms of England, and revived by Edward III in 1340, when he claimed the crown of France. Except during the reigns of Elizabeth and Anne, who used the motto *Semper eadem*, and of William III, who personally used *Je maintiendrai*, it has ever since been the royal motto of England.

Diez (dêts), Friedrich Christian, German philologist of the Romance languages, born in 1704, died in 1876. Having qualified himself as a lecturer at Bonn, he was appointed professor of the Romance languages there in 1830. His work stands in much the same relation to the Romance dialects which the researches of Grimm occupy with respect to German dialects. In addition to various works on the poetry of the Troubadours, he published a very valuable *Grammatik der Romanischen Sprachen* (1836-42, translated into English by Cayley in 1863), and an *Etymologisches Wörterbuch der Romanischen Sprachen* (1853).

**Difference**, a stock-exchange term. When stock is bought or sold merely as a speculation for the rise or fall, with no intention of the buyer to 'take up' the stock, or of the seller to deliver it, the 'difference' is the movement in price which may take place between the date of the transaction and the following 'settling-day'. If the price falls, the buyer has to pay the difference upon 'carrying over' his purchase to the next account; if it rises, the seller is at the loss. Since the first weeks of the European War all stock-exchange transactions have been made, in theory at least, for cash, and speculative business of this nature has been consequently much reduced.

**Differences, Finite**, a calculus much used in actuarial work, which deals with a series of numbers by considering the differences of the successive terms.

If  $u_1, u_2, u_3, \dots$  are the terms of the series, then  $u_2 - u_1, u_3 - u_2, u_4 - u_3, \dots$  form another series called the series of first differences. The notation used is  $u_2 - u_1 = \Delta u_1, u_3 - u_2 = \Delta u_2, \dots$

These first differences may themselves be differenced, giving the second differences  $\Delta u_2 - \Delta u_1, \Delta u_3 - \Delta u_2, \dots$ , which are written  $\Delta^2 u_1, \Delta^2 u_2, \dots$

Similarly, we form the third differences  $\Delta^3 u_1 = \Delta^2 u_2 - \Delta^2 u_1$ , and so on.

As an example, let the original series be the cubes of the natural numbers.

1	8	27	64	125	216	343	512
7	19	37	61	91	127	169	
12	18	24	30	36	42		
6	6	6	6	6			
0	0	0	0				

Here we begin by writing down the series of cubes as far, say, as 216; beneath these we write the first differences  $8 - 1 = 7, 27 - 8 = 19, \&c.$  We thus obtain the part of the table to the left of the diagonal line.

We observe that the third differences are

constant, each being 6. (It is easy to prove generally that the  $n$ th differences of the series,  $1^n, 2^n, 3^n, \dots$ , are constant.) Knowing the third differences, we can now extend the table as far as we wish to the right of the diagonal line. We get first  $6 + 30 = 36, 36 + 91 = 127, 127 + 216 = 343$ . We infer that  $7^3 = 343$ .

Since  $u_1 - u_0 = \Delta u_0$ , we have  $u_1 = u_0 + \Delta u_0 = (1 + \Delta)u_0$ .

Similarly,  $u_2 = (1 + \Delta)u_1 = (1 + \Delta)^2 u_0$ ; and generally,

$$\begin{aligned} u_x &= (1 + \Delta)^x u_0 \\ &= \left\{ 1 + x\Delta + \frac{x(x-1)}{1 \cdot 2} \Delta^2 + \dots \right\} u_0 \\ &= u_0 + x\Delta u_0 + \frac{x(x-1)}{1 \cdot 2} \Delta^2 u_0 + \dots \end{aligned}$$

a formula much used by calculators, and known as Newton's interpolation formula.

The above symbolic method of proof only applies when  $x$  is a positive integer, but the result is used in practice even for fractional values of  $x$ , as in most cases the high differences become negligible.

If  $n$  is a positive integer, it is easy to prove that

$$\Delta^n u_x = u_{x+n} - nu_{x+n-1} + \frac{n(n-1)}{1 \cdot 2} u_{x+n-2} - \dots$$

If the  $n$ th differences vanish, or are negligible, this gives

$$\begin{aligned} 0 &= u_{x+n} - nu_{x+n-1} + \frac{n(n-1)}{1 \cdot 2} u_{x+n-2} - \dots \\ &\quad + (-1)^n u_x, \end{aligned}$$

another useful interpolation formula, by which we can calculate any missing term of a series.—  
BIBLIOGRAPHY: G. Boole, *Finite Differences*; *Textbook of the Institute of Actuaries*.

**Differential Equation**, an algebraical relation involving derivatives or differentials. Examples:

$$\frac{d^2x}{dt^2} = g; ydx + xdy + zdz = 0.$$

An *ordinary* differential equation involves only one independent variable, a *partial* differential equation involves more than one. Examples of ordinary equations:

$$\frac{d^2y}{dx^2} + \frac{1}{x} \frac{dy}{dx} + y = 0; \frac{d^2x}{dt^2} + a \frac{dy}{dt} + px + qy = 0.$$

Examples of partial differential equations:

$$x \frac{dz}{dx} + y \frac{dz}{dy} = nx; \frac{d^2u}{dx^2} + \frac{d^2u}{dy^2} + \frac{d^2u}{dz^2} = 0.$$

Equations, whether ordinary or partial, can



also be classified as *linear* or *non-linear*. A linear equation is a rational integral equation of the first degree in the dependent variable or variables and their derivatives. The equation

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 + 1)y = 0$$

is linear, but

$$\left(\frac{dy}{dx}\right)^2 = xy \text{ and } y \frac{dy}{dx} = x^2$$

are non-linear. The *order* of an equation is the order of the highest derivative or differential which it contains. Of the three equations last written, the first is *linear of the second order*, the other two are of the *first order and second degree*. To *integrate* a differential equation or system of equations is to find a relation or relations among the variables, equivalent to the given equation or equations. Thus the integral of

$$\frac{dz}{dt} = g \text{ is } z = \frac{1}{2}gt^2 + At + B,$$

where  $A$  and  $B$  are *arbitrary constants*. An ordinary equation of the  $n$ th order with one dependent variable has exactly  $n$  arbitrary constants in its complete integral, or solution. In a practical problem the arbitrary constants are determined by the *initial*, or *boundary*, *conditions*. The solution of  $\frac{dz}{dt} = g$ , e.g. is completely determinate if the values of  $z$  and  $\frac{dz}{dt}$  when  $t = 0$  are given. The solution of *partial* equations may involve arbitrary *functions*, which become definite when proper initial or boundary conditions are assigned. Thus the equation  $\frac{du}{dx} = \frac{du}{dt}$  has for its complete solution  $u = \phi(x + t)$ , where  $\phi$  may be a function of any form whatever; if now we are given that, when  $t = 0$ ,  $u =$  a given function  $f(x)$ , we obtain  $f(x) = \phi(x)$ , so that the solution required is  $u = f(x + t)$ . Certain ordinary linear equations of the second order are specially important, both from the beauty of their theory and from their usefulness in Mathematical Physics. Some of these equations are: Bessel's equation, Legendre's equation, the hypergeometric equation, Mathieu's equation, Lamé's equation. Linear partial equations of the second order are fundamental in Physics. Such are: Laplace's equation,

$$\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0;$$

the wave equation,

$$\frac{\partial^2 V}{\partial t^2} = c^2 \left( \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} \right);$$

the equation of conduction of heat,

$$\frac{\partial V}{\partial t} = k \left( \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} \right).$$

These involve one dependent variable only. Equations with several dependent variables occur in Elasticity, Electrodynamics, and Hydrodynamics. A notable feature of the hydrodynamical equations is that they are not linear.

No general rules exist enabling us to deal with a differential equation taken at random, and only a few types have been completely solved. Of soluble equations, the most important are those which are *linear with constant coefficients*.

**Example 1.**  $\frac{d^2 x}{dt^2} - 7 \frac{dx}{dt} + 12 = 0$ . To solve this, try  $x = e^{mt}$ . We find  $e^{mt}(m^2 - 7m + 12) = 0$ . Thus  $m = 3$  or  $4$ . It is now easy to show that  $x = Ae^{3t} + Be^{4t}$  is a solution, where  $A$  and  $B$  are arbitrary constants. This is the general solution. We can determine  $A$  and  $B$  if the values of  $x$  and  $\frac{dx}{dt}$  are given for a definite value of  $t$ , say  $t = 0$ .

**Example 2.**  $\frac{d^2 y}{dt^2} = c^2 \frac{d^2 y}{dx^2}$ . Try  $y = e^{ix + mt}$ . We find  $m^2 = c^2 i^2$ , or  $m = \pm ci$ . Hence  $y = Ae^{i(x+ct)} + Be^{i(x-ct)}$  is a solution for all values of  $A, B, i$ ; so, also, is the sum of any number of terms of similar forms. We may infer that the general solution is

$$y = f(x + ct) + F(x - ct),$$

where  $f$  and  $F$  are arbitrary functions. It is only in exceptional cases that an equation can be solved, as in these two examples, by an analytical formula; indeed, differential equations are the most fertile source of new functions in analysis. But, as in the analogous cases of algebraic equations and definite integrals, it may be quite possible to find, by methods of approximation, an arithmetical solution which is sufficient for the purpose in hand. — BIBLIOGRAPHY: H. T. H. Piaggio, *Differential Equations*; J. M. Page, *Ordinary Differential Equations*; A. R. Forsyth, *A Treatise on Differential Equations*; E. T. Whittaker and G. N. Watson, *Modern Analysis*.

**Diffraction**, a term applied to the bending that rays of light undergo in passing close to the edge of an opaque body. Thus when a beam of direct sunlight is admitted into a dark room through a narrow slit, and falls upon a screen

placed to receive it, there appears a line of white light bordered by coloured fringes; these fringes are produced by diffraction, and in the case given it may be seen that the red or long-wave rays are diffracted more than the blue rays. See *Interference*.

**Diffusion**, the gradual mixing of gases, liquids, or solids when brought into direct contact. When a block of lead is placed on a block of gold, with their smooth surfaces in close contact, it is found that, after several weeks, gold has diffused into the lead, and lead into the gold. In the case of gases, when a jar of oxygen and a jar of hydrogen are connected together by a tube or opening of any kind, they rapidly become mixed; and their mixture does not depend on gravity, but takes place in opposition to that force, as may be shown by placing the jar of hydrogen gas above the other. Oxygen is sixteen times heavier than hydrogen, bulk for bulk, but the heavier gas moves upwards and the lighter downwards, and the process of intermixture, or *diffusion*, goes on till the two gases are apparently equally distributed throughout the whole space. After that they have no tendency whatever to separate. Similarly, if two vessels, one containing oxygen and the other hydrogen, be connected by a tube which is stuffed with a plug of porous material, such as plaster of Paris, the gases gradually diffuse one into the other through the porous plug. The two gases, however, do not pass through the porous separator at equal rates, but in *inverse proportion to the square roots of the densities of the gases*. Thus in the case of two vessels, one containing hydrogen and the other oxygen, which is sixteen times as heavy as hydrogen, the hydrogen will pass towards the oxygen jar four times as quickly as the oxygen will pass towards the hydrogen jar. Kindred phenomena occur when two liquids that are capable of mixing, such as alcohol and water, are put in contact, the two gradually diffusing one into the other in spite of the action of gravity. In some cases, however, as where ether and water are employed, the diffusion is only partial, this result arising from the fact that these two liquids are not miscible in all proportions. When solutions of various solid bodies are placed in contact, interdiffusion also takes place. On the results of his examination of the phenomena of diffusion of liquids and salts across porous membranes or *septa*, Graham founded a method of separating *colloid* from *crystalloid* bodies, which he called *dialysis*.

**Digamma**, a letter which once belonged to the Greek alphabet, and which remained longest in use among the *Æolians*. It resembled our letter F, and hence was called *digamma*, that is, double F. It appears to have had the force of

f or v. Its existence was first pointed out by Richard Bentley.

**Digby**, Sir Everard, an English gentleman, born of a Roman Catholic family in 1578. He enjoyed some consideration at the court of Elizabeth and James I, by whom he was knighted. Having contributed money to the Guy Fawkes conspiracy, he was tried and hanged in 1605.

**Digby**, Sir Kenelm, eldest son of the preceding, born in 1603, died in 1605. He studied at Oxford, was knighted in 1623, and on the accession of Charles I was created a gentleman of the chamber, a Commissioner of the Navy, and governor of Trinity House. He soon afterwards went out at his own expense a small but successful squadron against the French and Venetians. In 1636 he became a Roman Catholic, and was imprisoned as a Royalist during 1642-3, when he was allowed to retire to the Continent. At the Restoration he returned to England, became a member of the Royal Society, and was much visited by men of science. He wrote numerous works: a *Treatise on the Nature of Bodies*, a *Treatise on the Nature and Operation of the Soul*, and *Of the Cure of Wounds by the Powder of Sympathy*.

**Digest**, a name originally given to a collection or body of Roman laws, digested or arranged under proper titles ~~by order~~ of the Emperor Justinian. Hence applied to any somewhat similar collection.

**Diges'ter**, a strong vessel of copper or iron, on which is screwed an air-tight cover with a safety-valve, the object being to prevent loss of heat by evaporation, and to enable boiling to take place at a high pressure. Water may be thus heated to 400° F.; at which temperature its solvent power is so greatly increased that bones are converted into a jelly.

**Diges'tion** is that process in the animal body by which the aliments are so acted upon that the nutritive parts are prepared to enter the circulation, and separated from those which cannot afford nourishment to the body. The organs effecting this process are called the *digestive organs*, and consist of the stomach, the great and small intestines, &c. (see *Intestine*, *Stomach*), the liver, and pancreas. When the aliments, after being properly prepared and mixed with saliva by mastication, have reached the stomach, they are intimately united with a liquid substance called the *gastric juice*, by the motion of the stomach. By this motion the aliments are mechanically separated into their smallest parts, penetrated by the gastric juice, and transformed into a uniform pulpy or fluid mass. The gastric juice acts upon the albuminous parts of the food, converting them into peptones, which can pass through organic membranes and thus enter the blood. This

action is aided by the warmth of the stomach. The pulpy mass, called *chyme*, proceeds from the stomach, through the pylorus, into that part of the intestinal canal called the small intestine, where it is mixed with the pancreatic juice, bile, and intestinal juice. The pancreatic juice converts starch into sugar, albumins into leucines, and emulsionizes fats, so that all these kinds of food are rendered capable of absorption. The process is aided by the intestinal juice. The bile also acts upon fats, and aids the food is formed into the *chyle*, which is absorbed into the system by the capillary vessels called *lacteals* (see *Chyle*; *Chyme*), while non-nutritious matters pass down the intestinal canal and are carried off.—BIBLIOGRAPHY: Hare, *Food Factor in Disease*; Taylor, *Digestion and Metabolism*.

**Digit** (dij'it; Lat. *digitus*, a finger), in arithmetic, any one of the ten numerals, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. Digit is also a measure of a finger's breadth, equal to  $\frac{1}{4}$  inch.

**Digit**, in astronomy, is the measure by which we estimate the quantity of an eclipse. The diameter of the sun or moon's disk is conceived to be divided into twelve equal parts, called *digits*; and according to the number of those parts the digits which are obscured, so many digits are said to be *obscured*.

**Digitain** (dij-i-tā'in), a vegetable alkaloid, the active principle of the *Digitális purpurea* or foxglove. It has a bitter taste, and is a strong poison, but is used medicinally, especially for the heart. See next article.

**Digitālis** (dij-), a genus of plants, nat. ord. Scrophulariaceæ, containing about twenty species of tall herbs, natives of Europe and Western Asia. The purple foxglove (*D. purpurea*) is a common wild flower in Britain, and several species are grown in gardens. Various preparations from the foxglove receive this name, and are used in medicine, principally in cases of heart disease.

**Digitigra'da** (*digitus*, finger, toe, and *gradus*, to walk), a section of the Carnivora, so called from their walking on the ends of their toes; as the dog, cat, and their allies. See *Plantigrade*.

**Digitō'rium**, a small portable dumb instrument having a short keyboard with five keys like those of a piano, used by piano-players for practice, to give strength and flexibility to the fingers.

**Digne** (dény), a town, France, capital of the department of Basses-Alpes, picturesquely situated on a mountain slope, 60 miles north-east of Marseilles. In 1629 a plague reduced the population from 20,000 to 1500. Pop. 7817.

**Dijon** (dê-zhōn; Lat. *Construm Divonense*), a town in Eastern France, capital of the department of Côte-d'Or, in a fertile plain, at the

foot of a range of vine-clad slopes, formerly surrounded by ramparts, which now furnish beautiful promenades. At some distance it is surrounded by a series of forts. Some of the buildings belong to the period when Dijon was capital of the dukedom of Burgundy, the chief being the cathedral of St. Bénigne, a building of vast extent with a lofty wooden spire above 300 feet high; the churches of Notre Dame and St. Michael; the ancient palace of the Dukes of Burgundy, now used as the hôtel de ville and museum; and the *palais de justice*, formerly the Parliament House of Burgundy. Dijon is the birth-place of Bossuet. It has important educational institutions and a valuable library. Industries: woollens, hosiery, candles, mustard, vinegar, chemicals, paper-hangings, tanneries, foundries, machine factories, cotton- and oil-mills. The trade is considerable, particularly in the wines of Burgundy. Pop. 76,847.

**Dike**, or **Dyke** (connected with the Gr. *teichos*, wall), a word variously used in different localities to represent a ditch or trench, and also an embankment, rampart, or wall. It is specially applied to an embankment raised to oppose the incursions of the sea or of a river, the dikes of Holland being notable examples of work of this kind. These are often raised 40 feet above the high-water mark, and are wide enough at the top for a common roadway or canal, sometimes for both. The Helder Dike, one of the largest, is about 6 miles in length and costly in upkeep. See *Embankment*.

**Dike**, or **Dyke**, in geology, a term applied to intrusive igneous masses, such as basalt, which fill up veins and fissures in the other rocks, and sometimes project on the surface like walls through their superior resistance to weathering.

**Dilapidation**, in English ecclesiastical law, is where an incumbent of a church living suffers the parsonage-house or outhouses to fall down, or be in decay for want of necessary repairs; or it is the pulling down or destroying any of the houses or buildings belonging to a spiritual living, or destroying of the woods, trees, &c., appertaining to the same. An outgoing incumbent (or his heirs) is liable for dilapidation to his successor. In general, the term is applied to the act of allowing or causing any lands, houses, &c., to become waste or to decay.

**Dilem'ma** (from Gr. *di-*, double, and *lemma*, proposition, assumption), in logic, a form of argument used to prove the falsehood or absurdity of some assertion, as in the following instance: If he did so he must be either foolish or wicked; but we know he is neither foolish nor wicked; therefore he cannot have done so. The two suppositions, which are equally untenable, are called the 'horns' of the dilemma.

**Dilettante** (di-let-tān'tā), an Italian expres-

sion, signifying a lover of the arts and sciences, who devotes his leisure to them as a means of amusement and gratification, being thus nearly equivalent to *amateur*. It is also used in reference to the trifler and dabbler in art and science. In 1734 a number of gentlemen founded in London a Dilettanti Society, which published a splendid work on *Ionian Antiquities*, 1769-1881 (4 vols.); *Specimens of Ancient Sculpture*, 1809, 1835.

**Dilke**, Sir Charles Wentworth, English writer and politician, son and grandson of men well known in their day, was born in 1843, died in 1911. He graduated at Cambridge, and was called to the Bar. His first work, *Greater Britain*, the result of a tour round the world from 1866 to 1867, became very popular. In 1868 he was elected member of Parliament for Chelsea, and he remained so up to 1885. After a few years' retirement (due to a divorce case) he became member of Parliament for Forest of Dean. He was Under-Secretary for Foreign Affairs, President of the Local Government Board, &c. He succeeded his father as owner of the *Athenæum*, and became the proprietor of *Notes and Queries*. *The Present Position of European Politics*, and *Problems of Greater Britain*, are among his works.

**Dill**, an umbelliferous plant, *Anethum graveolens*, a native of the southern countries of Europe, the fruits, commonly but erroneously called seeds, of which are moderately warming, pungent, and aromatic, and are employed medicinally as a carminative.

**Dillenia** *ceæ*, an order of plants, chiefly fine trees, inhabiting the East Indies, allied to *Rumiculacæ* and *Magnoliacæ*.

**Dillingen** (dilling-en), an old town, Bavaria, on the Danube, formerly the seat of a Jesuit university. Pop. 6291.

**Dillon**, John, Irish politician and agitator, born in Dublin in 1851, the son of John Blake Dillon (1816-66), a leader of the Young Ireland party. Educated at the Catholic University of Dublin and at the Royal College of Surgeons, he became a doctor of medicine. He identified himself with the Parnellite movement, and entered Parliament for Tipperary in 1880. An ardent Nationalist, not hesitating to incite his compatriots to lawlessness, he was sent to prison in 1888. Without a seat in Parliament from 1883 to 1885, he was returned in the latter year for East Mayo, which he represented thereafter. In 1918, after the death of John Redmond, he was elected chairman of the Irish Nationalist party, which, however, owing to the rise of the Sinn Féin party, was a nominal distinction only.

**Dilman'**, a town, Persia, province of Azerbaijan, 75 miles west of Tabreez. Pop. estimated at 15,000.

**Dilo'lo**, a small lake in Angola, near the southern boundary of Belgian Congo, lat. 11° 22' s.; long. 22° 34' E.; regarded as the source of the Zambesi.

**Dil'uents** (Lat. *diluere*, to wash away), in medicine, are those substances which are taken to increase the proportion of fluid in the blood. They consist of water and watery liquors.

**Dilu'vium**, the name formerly given by geologists to certain gravels and comparatively recent deposits, which seemed to have been the result of a rush of water or deluge.

**Dime** (Fr. *dime*, Lat. *decimus*, tenth), term for the tenth part of a dollar or ten-cent piece in the United States of America, a silver coin whose English equivalent is about 5d. Hence the phrases *dime novels*, *dime museums*, &c.

**Dimensions, Algebraical.** There are three dimensions in space: length, breadth, and height or depth. An area is said to be of two dimensions because it has length and breadth only; a volume is of three dimensions. In algebra terms like  $x^2$ ,  $xy$  are said to be of two dimensions because there are two letters multiplied together, and their product would measure an area if each letter denoted a length. Similarly,  $x^3$ ,  $xyz$  are said to be of three dimensions, and the meaning is extended to cover the product of any number of letters. An expression of more than one term is said to be of the same degree as its term of highest dimensions. For example,  $3x^2y^2z^2 + 5xyz + 6x^3 + 3x^2y^2$  is said to be of the sixth degree because  $x^2y^2z^2 = x \times x \times y \times y \times z \times z$  is of six dimensions.

**Dimensions, Physical.** One of the aims of physical science is to express all its measurements in terms of the three fundamental units of length, mass, and time. A velocity, for example, is specified by the number of units of length traversed in the unit of time, so that we may write  $v = l \div t$ , or  $v = lt^{-1}$ . On this account velocity is said to have the dimensions  $LT^{-1}$ . Similarly, acceleration, being velocity added per unit time, has the dimensions of velocity  $\div$  time, or  $LT^{-2}$ ; and force, being proportional to mass and acceleration jointly, has the dimensions  $MLT^{-2}$ .

When a physical law is expressed as an equation connecting the numbers of units of the quantities involved, every term in this equation must be of the same dimensions in any one of the fundamental units. This is the *Principle of Dimensions*, first stated by Joseph Fourier, founder of the theory of the conduction of heat. In order to see its truth, we have only to observe that an equation containing terms of different dimensions would give inconsistent results if the unit of length were varied. Suppose it to be suggested, for example, that the period of vibration  $t$  of a simple

pendulum of length  $l$  is given by the formula  $t = 2\pi\sqrt{l/g}$ , where  $g$  denotes the acceleration of a falling body. The dimensions of the expression on the right are  $L \div (LT^{-2})$ , or  $T^2$ , whereas the term  $t$  on the left has dimensions  $T^1$ . Suppose the unit of length is the foot and the unit of time the second, so that  $g = 32$ , and let  $l = 3$ . We find in this case  $t = \frac{6\pi}{32}$ , so that the period is  $\frac{3\pi}{16}$  seconds. But if we change the unit of time to one minute,  $g$  becomes  $60 \times 60$ , and the formula gives  $t = \frac{6\pi}{16 \times 60 \times 60}$ , so that the period is  $\frac{3\pi}{16 \times 60 \times 60}$  minutes.

The two results are obviously inconsistent. If, however, we take the correct formula, namely  $t = 2\pi\sqrt{l/g}$ , we find on trial that we obtain the same value for the period however we change the unit of time or the unit of length. Both sides are in this case of dimensions  $T^1$ .

The principle of dimensions provides therefore a useful check on the accuracy of formulae. But it does much more than this. It often gives very valuable information about the relations of physical phenomena in cases where these relations are far too complicated to be completely worked out by mathematical analysis. To mention but one example, it is by the use of this principle that modern naval architecture is able to predict the behaviour of ocean-going ships from experiments in ponds on small-scale models.

**Diminutive**, in grammar, a word having a special affix which conveys the idea of littleness, and all other ideas connected with this, as tenderness, affection, or contempt. The opposite of *diminutive* is *augmentative*. In Latin, diminutives almost always ended in *-lus*, *-la*, or *-lum*; as *Tulliola*, *meum corculum*, little Tullia my dear, or little heart; *homunculus*, a manikin. The Italian is particularly rich in diminutives and augmentatives, such compound diminutives as *fratellinucciettinello* (a diminutive of *frate*, brother) being sometimes employed. Among English diminutive affixes are *-kin*, as in *mantkin*, a little man; *pipkin*, a little pipe; *-ling*, as in *goshling*, a little goose; *darling*, that is, *dearling*, or little dear; and *-et*, as in *pocket*, from *poke*, a bag or pouch; *tablet*, a little table. Diminutives are not confined to nouns, and *dandle*, *scribble*, *tipple*, are examples of diminutive verbs, and *greenish*, *whitish*, are diminutives of adjectives. Diminutives are also formed, in colloquial and familiar language, by adding *-y* or *-ie* to the names, as *Charley*, *Mousie*, &c.

**Dim'ty**, a stout cotton fabric, ornamented in the loom either by raised stripes or fancy figures. It is usually employed white, as for bed and bedroom furniture.

**Dimorph'ism**, in crystallography, the crystallization of a body in forms belonging to two different systems, or in incompatible forms of the same system, a peculiarity exhibited by sulphur, carbon, &c.

**Dimorphism**, in botany. See *Heterostyly*.

**Dinajpur'**, a town, Hindustan, Bengal, capital of a district of same name, 205 miles north of Calcutta; pop. 12,500.—The district covers an area of about 4118 sq. miles; pop. 1,687,860.

**Dinan** (*dē-nān*), a town, France, department of Côtes-du-Nord (Brittany), on the Rance, 14 miles south of St. Malo. It was besieged and captured by the English under the Duke of Lancaster in 1359, but retaken by Du Guesclin. It stands on a steep hill nearly 200 feet above the river, is surrounded by high old walls pierced with four gates, and is a picturesque and interesting old place. In the cathedral of St. Sauveur the heart of Bertrand du Guesclin is buried. Pop. 11,410.

**Dinant** (*dē-nān*), a town, Belgium, in the province and 14 miles s. of Namur; picturesquely and strongly situated on the Meuse; a place of antique appearance. The town house was once the palace of the Princes of Liège. The town was destroyed by the Germans in 1914. It is one of the most popular Belgian summer resorts. Pop. 7690.

**Dina'pur**, a town, Hindustan, Patna district, Bengal, on the right bank of the Ganges, about 12 miles north-west of Patna, cantonment and military head-quarters of the district, with extensive barracks. The environs are studded with handsome bungalows. Pop. 31,025.

**Dinar** (Lat. *denarius*), formerly an Arab gold coin, also a Persian coin; at present the chief Serbian coin, value one franc.

**Dinas Bricks**, an infusible kind of brick made of a peculiar rock, containing 98 per cent of silica, with a little alumina, which occurs at Dinas, in the Vale of Neath, in Glamorganshire, S. Wales. The rock is crushed, moistened with water, and moulded by a machine.

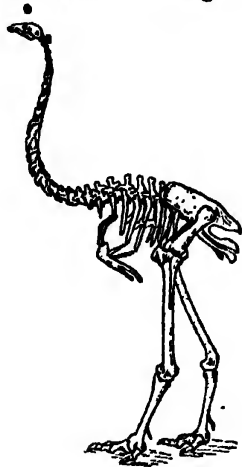
**Dindigul**, a town of India, Madura district, Madras, with a fort on a rocky height; manufactures cigars. Pop. 21,000.

**Dindings**, The, properly two small islands, also called Pangkor Islands, in the Straits of Malacca, belonging to the Straits Settlements, off the coast of Perak (British). The name now includes a strip of territory on the Malay Peninsula opposite; total area about 265 sq. miles, two-thirds of which is covered by dense forests. Coco-nuts, coffee, and pepper are grown with success. Lumut, on the mainland, has a fine natural harbour.

**Din'dorf**, Karl Wilhelm, German classical scholar, born 1802, lived most of his life at

Leipzig, and died 1888. His chief publications were editions of the Greek dramatists (*Poetae Scenici Graeci*) and works elucidative of them and other Greek writers.

Dingo, the native wild dog of Australia



*Dinornis maximus* (the Moa)

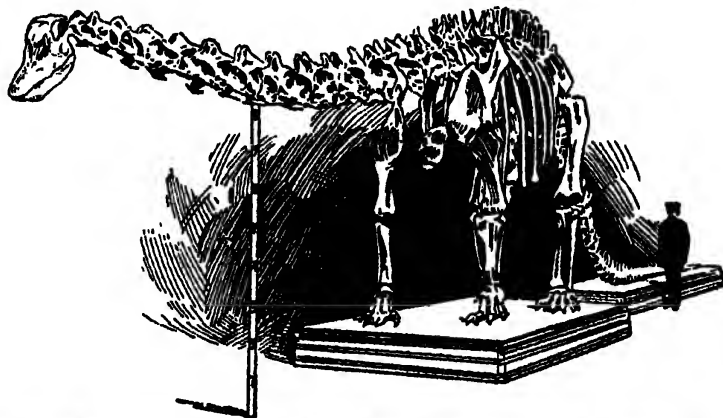
(*Canis Dingo*), of a wolf-like appearance and extremely fierce. The ears are short and erect, the head elongated, the tail rather bushy, and the hair of a reddish-dun colour. In habit the

Firth. This town was erected into a royal burgh in 1226 by Alexander II, and its charter was renewed by James IV. Pop. (1921), 2551.

Dino'ceras (Gr. *deinos*, terrible, *keras*, a horn), a fossil mammal found in the Eocene strata of North America, in some respects akin to the elephant and of equal size, but without a proboscis. Its bones were very massive; it had two vertical tusks in the upper jaw, three pairs of horns, and the smallest brain, proportionally, of any known mammal.

Dinor'nis (Gr. *deinos*, terrible, *ornis*, a bird), an extinct genus of large wingless birds—close with the small existing *Apteryx*. The bones of several species have been found in New Zealand. The largest must have stood 12 feet in height, several of its bones being at least twice the size of those of the ostrich. The body seems to have been even more bulky in proportion, the tarsus being short and stout in order to sustain its weight. They do not appear to have become extinct until the seventeenth or eighteenth century, and are spoken of as *moas* by the natives, who buried the eggs (more than 1 foot long) with their dead as provision for their journey to the other world.

Dinosaur'ia (Gr. *deinos*, terrible, and *sauros*, a lizard), a group of extinct reptiles, allied in skeletal structure both to the lizards and the birds. While some were only 8 feet long, a large number attained gigantic size, *Atlantosaurus*



*Diplodocus Carnegii*, a gigantic Dinosaur. Length, 84 feet 9 inches; height at middle of back, 11 feet 5 inches

dingo is rather fox-like, usually lying concealed throughout the day and making predatory expeditions at night. It is very destructive to sheep, killing more than it eats. It was probably introduced by prehistoric man.

Ding'wall, a royal and parliamentary burgh and seaport of Scotland, county town of Ross and Cromarty, situated at the head of Cromarty

being 115 feet long. Many were carnivorous, but some of the large heavy forms were herbivorous, and protected by bony spines or plates. The Dinosaurs were the dominant land animals of the Jurassic and Cretaceous periods.

Dinothe'rium (Gr. *deinos*, terrible, *thērion*, beast), a genus of extinct gigantic proboscidean mammals, precursors of the elephants, the

remains of which occur in Miocene formations in several parts of Europe. The type-species (*D. giganteum*) is calculated to have attained the length of 18 feet. It had a proboscis and also two tusks placed at the anterior extremity of the lower jaw, and curved downwards somewhat after the manner of those in the upper jaw of the walrus. The skull is best known from that found in 1835 at Eppelsheim; but the skeleton can now be pieced together from fragments in various localities. The vertebrae resemble those of mastodon. *Dinotherium* may have inhabited rivers or estuaries.

**Diocese** (Gr. *diokēsis*, administration), the precinct or extent of a bishop's jurisdiction. Each English diocese is divided into archdeaconries,



Skull of *Dinotherium giganteum*

each archdeaconry (nominally) into rural deaneries, and each deanery into parishes. In the Eastern Churches the term *eparchy* is used for diocese. See *Bishop*.

**Diocletian** (Gaius Valerius Diocletianus, surnamed *Jovius*), a man of mean birth, a native of Dalmatia, proclaimed Emperor of Rome by the army A.D. 284. He defeated Carinus in Mesia (286), conquered the Allemanni, and was generally beloved for the goodness of his disposition, but was compelled by the dangers threatening Rome to share the government with M. Aurelius Valerius Maximian. In 292 Galerius and Constantius Chlorus were also raised to a share in the empire, which was thus divided into four parts, of which Diocletian administered Thrace, Egypt, Syria, and Asia. As the result of his reconstitution of the empire there followed a period of brilliant successes in which the barbarians were driven back from all the frontiers, and Roman power restored from Britain to Egypt. In 305, in conjunction with Maximian, he resigned the Imperial dignity at Nicomedia, and retired to Salona, in Dalmatia, where he cultivated his garden in tranquillity until his death in 318. In the latter part of his reign he was induced to sanction a persecution of the Christians.—**BIBLIOGRAPHY:** Gibbon,

*Decline and Fall*; P. Allard, *La Persécution de Dioclétien*; A. J. Mason, *The Persecution of Diocletian*.

**Dioda'ti**, Giovanni, Italian Protestant divine, born at Lucca, about 1576, of a noble Catholic family. He was for some time professor, first of Hebrew, then of theology, at Geneva, and in 1619 represented the Genevan clergy at the Synod of Dort, and aided in drawing up the Belgic confession of faith. He is most celebrated for a translation of the Bible into Italian (1607), which is superior to his translation of it into French. He died at Geneva in 1640.

**Diódorus** of Agrigum, in Sicily, and therefore called *Sticulus*; a Greek historian in the time of Julius Cæsar and Augustus. His universal history, in the composition of which he travelled through a great part of Europe and Asia, occupied him thirty years, and consisted of 40 books, but only books 1-5 and 11-20, with certain fragments, are now extant.

**Diœcious** (Gr. *di*, double, *oikos*, a house), in botany, a term applied to plants which have flowers with stamens on one individual and those with pistils on another; as opposed to *monœcious*. The willow, the yew, the poplar, &c., are diœcious.

**Diogenes Laërtius**, author of a sort of history of philosophy in Greek, appears to have been born at Laerte, in Cilicia, and to have lived towards the close of the second century after Christ; but no certain information exists either as to his life, studies, or age. The work is divided into ten books, and bears in MSS. the title, *On the Lives, Doctrines, and Apophthegms of those who have distinguished themselves in Philosophy*. It is full of absurd and improbable anecdotes, but contains valuable information regarding the private life of the Greeks, and many fragments of works now lost. It was the foundation of the earlier modern histories of philosophy. A translation of his work by C. D. Yonge was published in Bohn's Classical Library.

**Diogenes** (di-ój'ē-nēs) of Apollonia (Crete), known also as the *Physicist*, a Greek philosopher of the fifth century B.C., who belonged to the Ionian school, and considered air as the element of all things. He was a pupil of Anaximenes and a contemporary of Anaxagoras.

**Diogenes of Sinopë** (on the Black Sea), the most famous of the Cynic philosophers, born about 412 B.C., died about 323 B.C. Having been banished from his native place with his father, who had been accused of coining false money, he went to Athens, and thrust himself upon Antisthenes as a disciple. Like Antisthenes he despised all philosophical speculations, and opposed the corrupt morals of his time; but while the stern austerity of Antis-



thenes was repulsive, Diogenes exposed the follies of his contemporaries with wit and good humour. As an exemplar of Cynic virtue he satisfied his appetite with the coarsest food, practised the most rigid temperance, walked through the streets of Athens barefoot, without any coat, with a long beard, a stick in his hand, and a wallet on his shoulders, and by night, according to the popular story, slept in a tub (or large earthenware vessel). On a voyage to the Island of Ægina he fell into the hands of pirates, who sold him as a slave to the Corinthian Xenitades. The latter emancipated him, and entrusted him with the education of his children. He attended to the duties of his new employment with the greatest care, commonly living in summer at Corinth and in winter at Athens. It is at Corinth that he is said to have had his famous interview with Alexander the Great. The Macedonian conqueror was so struck with the philosopher's self-possession that he went away remarking: "If I were not Alexander, I should wish to be Diogenes". Of the many stories related of him the majority are probably fictions; many, indeed, are chronologically impossible. Concerned with practical wisdom, Diogenes established no system of philosophy. To gain virtue, he maintained, man must avoid physical pleasure, despise the conventions of society, and adopt a simple and natural life. His enemies accused him of various scandalous offences, but there is no ground for supposing him guilty of any worse fault than that of elevating impertinence to the rank of a fine art. See *Cynics*.

**Diomedes** (di-o-mé'déz), in Greek mythology, (1) the son of Mars and Cyrene, and King of the Bistónes in Thrace, who fed his horses on human flesh, and used to throw all strangers who entered his territories to those animals to be devoured. He was killed by Hercules, who carried off the horses. (2) One of the heroes at the siege of Troy, the son of Tydeus and Deïpyræ, and King of Argos, one of the suitors of Helen. After she was carried off, Diomedes engaged in the expedition against Troy, in which his courage and the protection of Pallas rendered him one of the most distinguished heroes. He wounded Aphrodite and Ares, and thrice assailed Apollo; and by carrying off the horses of Rhæsus from the enemies' tents, and aiding Ulysses in the removal of Philoctetes from Lemnos, he fulfilled two of the conditions on which alone Troy could be conquered. Finally he was one of the heroes concealed in the wooden horse by which the capture of Troy was at length accomplished. Different accounts were given of his after-life. He is often called *Diomedes*.

**Dionæa**, a genus of plants, nat. ord. Droseraceæ. Only one species is known, *D. muscipula*

(Venus's fly-trap), a native of the sandy savannas of Carolina and Florida. It has a rosette of root-leaves, from which rises a naked scape bearing a corymb of largish white flowers. The leaves have a dilated petiole and a slightly stalked 2-lobed lamina, with three short stiff bristles on each lobe. The bristles are remarkably irritable, and when touched by a fly, or other insect, the lobes of the leaf suddenly close on and capture the insect. It dissolves the food thus captured by means of digestive fluid similar to ordinary gastric juice.

**Dion Cassius**, or **Dio Cassius**, a historian, born about A.D. 155 at Nicæa in Bithynia. After accompanying his father Cilicia, of which he held the administration, came to Rome about 180, and obtained the rank of a Roman Senator. On the accession of Pertinax Dion was appointed Prætor, and in the reign of Caracalla he was one of the Senators whom it had become customary to select to accompany the emperor in his expeditions, of which he complains bitterly. In 219 he was raised to the consulship, and about 224 became Proconsul of Africa. In 229 he was again appointed Consul; but feeling his life precarious under Alexander Severus, he obtained permission to retire to his native town of Nicæa. The period of his ~~life~~ <sup>life</sup> is unknown. The most important of his writings, though only a small part is extant, is a *History of Rome*, written in Greek and divided into eighty books, from the arrival of Æneas in Italy and the foundation of Alba and Rome to A.D. 229.

**Dion Chrysostom**, a Greek sophist and rhetorician and a favourite of Trajan; born A.D. 50, died about A.D. 110. Eighty of his orations (in excellent Attic) have been preserved.

**Dion of Syracuse**, in Greek history, a connection by marriage of the elder and the younger Dionysius, tyrants of Syracuse, over whom he long exercised great influence. He attempted to reform the younger Dionysius, but his enemies succeeded in effecting his banishment. He afterwards returned and made himself ruler of the city, but became unpopular, and in 353 B.C. one of his followers, Callippus of Athens, caused him to be assassinated.

**Dionys'ia**. See *Bacchanalia*.

**Dionys'ius**, St., a disciple of Origen, and Patriarch of Alexandria in A.D. 248. He was driven from the city in 250, and in 257 was banished to Libya, but was restored in 260. He died in A.D. 265.

**Dionysius of Halicarnassus**, in Caria, a Greek critic and teacher of eloquence, born about 70 B.C. He went to Rome about 80 B.C., where he wrote his *Roman Antiquities*, in twenty books, in which he relates (in Greek) the early history of Rome and its government up



times of the first Punic War. We have the first nine books of this work entire, the tenth and eleventh nearly so, and some fragments of the others. His rhetorical writings are of greater value, especially his essays on the Greek orators. He died about 6 B.C.—Cf. Sir J. E. Sandys, *A History of Classical Scholarship*.

**Dionysius the Areopagite**, that is, one of the judges of the Areopagus, at Athens, a convert to Christianity by the Apostle Paul about the middle of the first century, and the first bishop of Athens, where he suffered martyrdom. In writings formerly ascribed to him consist of obscurely written treatises on mystical subjects. Scotus Erigena translated them into Latin. In France, where a certain Dionysius (see *Denis, St.*) established the first Christian community at Paris in the third century, they were readily received, this Dionysius being without further inquiry taken for the Areopagite, because the origin of the Gallican Church might thus be carried back to the first century; and France gained a patron who was a martyr and the immediate disciple of an apostle.—Cf. article in *Smith's Dictionary of Christian Biography*.

**Dionysius the Elder**, in Greek history, tyrant and absolute ruler of Syracuse, born about 480 B.C. of obscure parentage. He obtained the rank of general, and afterwards of commander-in-chief; and, gaining the support of the army, he seized the supreme power in Syracuse, though only twenty-five years of age. He extended his rule over other cities in Sicily; and after some successes and reverses in the struggle with the Carthaginians, he gained a complete victory over them under the walls of Syracuse. In his expeditions into Lower Italy he reduced the city of Rhegium by famine (387). After another short war with Carthage he lived some time in peace, occupied with writing poems and tragedies, with which he contended for the Olympian prize. In 368 he commenced a new war against the Carthaginians, but failed to drive them entirely out of Sicily. He is said to have died from a poison administered at the instigation of his son Dionysius the Younger (367 B.C.).

**Dionysius the Little** (so called on account of his short stature), a Scythian monk who was abbot of a monastery at Rome in the beginning of the sixth century, and died about the year A.D. 580, according to others about 545, celebrated as the first to introduce the computation of time from the Christian era. This mode of computation, however, was not publicly used until the eighth century.

**Dionysius the Younger**, a tyrant of Syracuse, who succeeded his father, Dionysius the Elder, in 367 B.C. For the purpose of recalling him

from the excesses to which he was addicted, his kinsman Dion persuaded him to invite Plato to his court, but the influence of the philosopher effected no permanent change. Becoming suspicious of Dion, the tyrant banished him and confiscated his property, but in 357 B.C. Dion made himself master of Syracuse. Dionysius fled to Locri, but after the murder of Dion recovered his power in Syracuse. His misfortunes, however, had rendered him more cruel, and Timoleon, who came to Syracuse with aid from Corinth against the Carthaginians, deposed him in 344 B.C. He was carried to Corinth, where he is said to have gained a living by giving lessons in grammar, or as one of the attendants on the rites of Cybele.

**Dionysus**, the original Greek name of the god of wine, the name Bacchus, by which he was also called both by the Greeks and the Romans, being at first a mere epithet or surname.—Cf. R. Brown, *The Great Dionysiac Myth*.

**Dioon**, a genus of Cycads, natives of Mexico, where meal is prepared from the starchy seeds.

**Diophantus of Alexandria**, the first Greek writer on algebra, flourished, according to some authorities, about the middle of the fourth century after Christ. He is called the Father of Algebra, and left behind him thirteen books of *Arithmetical Questions*, of which only six are extant; and a work on *Polygonal Numbers*.

**Diopside**, a calcium magnesium silicate, of the pyroxene series, occurring in igneous rocks and altered limestones, with a vitreous lustre, and of a pale-green, or a greenish- or yellowish-white colour.

**Diopside**, a genus of two-winged flies of which the species are native to India and Africa. Each side of the head is drawn out into a long lateral horn, which bears the eye and antenna at its extremity.

**Diopside**, emerald copper ore, hydrated silicate of copper, a translucent mineral, occurring crystallized in six-sided prisms. It occurs in Siberia, Hungary, and Chile. It has been used as a gem-stone, notably in Persia and Russia.

**Diopter**, the unit in terms of which the power of a lens or curved mirror can be expressed. It is obtained by taking the reciprocal of the focal length of the lens or mirror in metres. Thus, a lens with focal length 1 metre has a power of 1 diopter. If the focal length is 2 metres, the power is  $\frac{1}{2}$  diopter. The power may also be obtained by dividing 39.37 by the focal length in inches. The unit is employed in classifying spectacle lenses.

**Diorite**, a coarsely crystalline igneous rock, sometimes of a whitish colour speckled with black or greenish-black, sometimes very dark

in colour, consisting of hornblende and calcium sodium felspar. Dark mica sometimes takes the place of hornblende (mica-diorite). The 'green-stones' of older authors are mostly diorites.

**Dioscoreaceæ**, a nat. ord. of monocotyledons, with alternate reticulate-veined leaves, tuberous root-stocks, and twining stems. The flowers are small and unisexual. There are 6 genera, with about 100 species. The typical genus is *Dioscorea*, which includes the yam. Black bryony is the only British representative.

**Dioscor'ides**, Pedanius, a Greek physician, born in Cilicia in the first century of the Christian era. He was the author of a celebrated work on *materia medica*, in five books, particularly valuable in regard to botany.

**Dioscu'ri**. See *Castor and Pollux*.

**Dios'pyros**, a large genus of trees or shrubs, natives of the warmer regions of the world, nat. ord. Ebenaceæ. The trees of this genus supply ebony wood. That from Ceylon is the wood of *D. Ebenum*; from India, of *D. melanoxylon* and other species; and that from Mauritius, *D. tesselaria*. The Chinese date-plum (*D. kaki*) is an apple-like tree which produces large red fruits resembling tomatoes. In China and Japan this tree is as important as the apple is in Northern Europe.

**Dip**, of the horizon, the angle of depression of the visible horizon at sea below the true horizontal direction, due to the height of the eye above the level of the sea. The dip in minutes of arc is approximately equal to the square root of the height in feet.—**Dip, magnetic**, or **Inclination**, is the angle which a magnetic needle free to move in a vertical circle in the magnetic meridian makes with the horizon. See *Dipping Needle*.

**Dip**, in geology, the inclination or angle at which strata slope or *dip* downwards into the earth. The degree of inclination or amount of the dip, which is easily measured by a *clinometer*, is the steepest angle made with a horizontal plane by a line drawn in the surface of the stratum. The line of dip is hence perpendicular to the intersection of the stratum with the horizontal, which is called the *strike*.

**Dip Circle**. See *Dipping Needle*.

**Diphthe'ria** is an acute infectious disease characterized by the formation of membrane in the throat and air-passages, and associated with severe disturbances affecting especially the heart and nervous system. It is due to a bacillus described by Koch in 1883. It is essentially a disease of the early years of life, and the period between two and twelve years covers the vast majority of cases. The commonest modes of infection are direct and indirect contact, infected milk, and defective drains. Of late years, the domestic cat has been held to be a source of

infection. The disease runs a rapid course, beginning with fever, headache, chilliness, lassitude, and occasionally vomiting, while usually there is early complaint of sore throat. The membrane, which appears on the side of the throat, is usually of a dirty yellowish-white colour. It may be limited to a small area, but usually, if untreated, it would spread extensively over the throat, involving the palate and uvula. Diphtheria beginning in the larynx (windpipe) is what is popularly called *croup* (q.v.). There is danger of death in severe cases, during the first few days from early heart failure, and almost any time during convalescence late heart failure may occur. Late heart failure is one of the forms of post-diphtheritic paralysis which arise from disturbances of the nervous system. The other common varieties are paralysis of the palate, of the pharynx, of the eye muscles, and of the respiratory muscles. An effective treatment is found in diphtheria antitoxin, which should be administered as early as possible in the disease. It is given by the skin, and the dose is regulated by the severity of the attack.—**BIBLIOGRAPHY**: W. Litchfield, *Diphtheria in Practice*; W. Smith, *Harben Lectures*.

**Diphthong** (Gr. *di-*, double, and *phthongos*, sound), a coalition or union of two vowels pronounced in one syllable. In uttering a diphthong both vowels are pronounced; the sound is not simple, but the two sounds are blended as to be considered as forming one syllable, as in *void*, *bough*. The term improper diphthong is applied to the union in one syllable of two or more vowels of which only one is sounded, as in *bean*.

**Diphyodont**, a term applied to those animals which develop two sets of teeth, a deciduous or milk set, and a permanent set—as distinct from the monophyodonts, which develop only one set. The majority of mammals are diphyodont, though the number of teeth replaced may vary; thus in man twenty teeth of the adult are preceded by a milk set.

**Diplacan'thus**, a genus of ganoid fishes, found only in the Old Red Sandstone. They have small scales, a heterocercal tail, and two dorsal fins with a strong spine in front.

**Diplei'doscope**, an instrument for indicating the passage of the sun or a star over the meridian, by the coincidence of two images of the object, the one formed by single and the other by double reflection. It consists of an equilateral hollow prism, two of whose sides are silvered on the inside so as to be mirrors, while the third is formed of glass. The prism is adjusted so that one of the silvered sides shall be exactly in the plane of the meridian, and the transparent side towards the object.

**Diploid Phase**, in botany. See *Generations, Alternation of*.

**Diplo'ma** (Gr. *diplōma*, from *diploō*, to double or fold), literally a document folded but once, and therefore divided into two parts. It is used to signify a document signed and sealed, in which certain rights, privileges, or dignities are conferred, especially a university degree.

**Diplo'macy**, the science or art of foreign politics. In a more restricted sense the term notes the science or art of conducting negotiations and arranging treaties between states or nations; the branch of knowledge which deals with the relations of independent states to one another; the agency or management of envoys accredited to a foreign court; the forms of international negotiations. The word, borrowed from the French, was first used in England in 1796 by Burke. The Cardinal de Richelieu is generally considered as the founder of what regular and uninterrupted intercourse between Governments which exists at present between almost all the Christian powers; though the instructions given by Machiavelli to one of his friends, who was sent by the Florentine Republic to Charles V (Charles I of Spain) show that Richelieu was not the first to confer the advantages that might be derived from the correspondence of an intelligent agent accredited at the seat of a foreign Government.

As a uniform system, however, with a fixed international status, diplomacy was only established in the nineteenth century at the Congresses of Vienna (1815) and Aix-la-Chapelle (1818). Amongst the European powers it is agreed that of ministers of the same rank he who arrives first shall have the precedence over his colleagues. —**BIBLIOGRAPHY:** D. J. Hill, *History of Diplomacy in the International Development of Europe*; E. C. Grenville-Murray, *Embassies and Foreign Courts: a History of Diplomacy*; P. Pradier-Fodéré, *Cours de droit diplomatique*; L. Oppenheim, *International Law*; D. P. Heatley, *Diplomacy and the Study of International Relations*.

**Diplomat'ics**, originally the science of deciphering ancient MSS. It laid down certain principles for the systematic examination of public documents, and taught the forms and styles adopted in them, and the titles and rank of public officers subscribing them. Among the earliest exponents of diplomat'ics were Daniel van Papenbroeck, an Antwerp Jesuit (1075), and Mabillon (*De Re Diplomatica*, 1681).

**Diplomatic Service**, The, as now existing, may be said to have originated in the Venetian Republic, which employed ambassadors as early as the thirteenth century. At first these officials had a very brief term of office, rarely remaining at their post in a foreign country for more than two or three months. By the middle of the

fifteenth century, however, a permanent Milanese embassy had been established at Genoa, followed by one at Paris in 1494; while two years later Venice was officially represented at London. The clergy, who for the most part alone possessed the requisite accomplishments for such work, were the usual ambassadors of the Middle Ages; but by the sixteenth century lawyers, or not seldom merchants, were employed. It was not till two hundred years later that the modern attachés, junior officials of an embassy, came into being. The diplomatic service of Great Britain, controlled by the Foreign Office, includes (1) ambassadors, and (2) envoys and ministers plenipotentiary, both of which ranks represent the person of their sovereign and enjoy numerous special privileges in the country to which they are sent. Of lower standing are (3) ministers resident and (4) chargés d'affaires; the last-named are accredited, not to a sovereign, but to his foreign minister, and frequently act merely as temporary substitutes for an ambassador. Secretaries of more than one grade, with naval, military, and, of late years, commercial attachés, also form members of an embassy. Candidates for the British diplomatic service require a nomination from the Foreign Secretary, must be between the ages of nineteen and twenty-five, are subjected to an examination, and are almost invariably young men of good birth and position. The service is distinguished and affords a pleasant, if to some extent an idle life; but it does not offer any prospect of financial fortune. Lord Stratford de Redcliffe (the 'Great Elchi') and Lord Lyons rank high among distinguished British ambassadors. See *Civil Service*.

**Diplozo'on**, a parasitic trematode worm which infests the gills of the bream, and which appears to be formed of two distinct bodies united in the middle, and resembling an X or St. Andrew's cross, two sexually mature individuals being thus united.

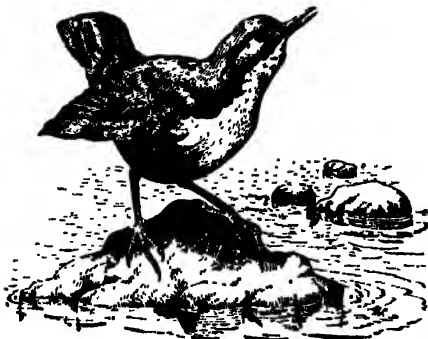
**Dip'noi**, mud-fishes or lung-fishes, an ancient order now represented by three genera—*Neoceratodus*, *Protopterus*, and *Lepidosiren*. Like some adult Amphibia they possess both gills and lungs, the latter corresponding to a specialized swim-bladder. The heart has two auricles instead of one only, as in all other fishes. The single species of *Neoceratodus* (*N. forsteri*) is a large form with paddle-like fins and large overlapping cycloid scales. It is native to the Burnett and Mary Rivers of Queensland. *Protopterus* is represented by three African species, which inhabit rivers and swamps from the Senegal to the Zambezi. It is smaller than *Neoceratodus*, somewhat eel-shaped, with very narrow fins, and small cycloid scales embedded in the skin. It spends the summer in a torpid condition, buried

in the mud, and is dug up by the natives as an article of food. *Lepidosiren* includes a single South American species (*L. paradoxa*) ranging from the Amazon to Paraguay. It is closely related to *Protopterus*, which it resembles in shape and the character of the fins.

Dippel, Jöüann Conrad, German theologian and alchemist, born 1672, died 1734. He studied theology, defended the orthodox party against the Pietists, led a turbulent life at Strasbourg, and then joined the Pietists until an unfortunate tractate placed him in disfavour with both parties. He then turned his attention to alchemy, and during a residence at Berlin produced the oil called after him, from which indirectly followed the discovery of Prussian or Berlin blue. After various adventures and wanderings in Sweden, Denmark, and Germany, he died at Berleburg.

Dippel's Oil, a pharmaceutical preparation obtained by the destructive distillation of animal matter, such as horn, ivory, blood. The crude form was refined by Dippel, and at one time was a good deal used in medicine as a diaphoretic and hypnotic. It is a form of bone oil, a product obtained in the manufacture of bone-black, or animal charcoal, by the distillation of bones. Crude bone oil has a most offensive smell. It contains the carbonate and other salts of ammonium, and a large variety of organic substances.

Dipper, a bird of the genus *Cinclus*, allied to the wrens. The common dipper, water-ouzel,



Dipper (*Cinclus aquaticus*)

or water-crow (*Cinclus aquaticus*), is a familiar European bird; it is about 7 inches in length, with a very short tail, small rounded wings, and large powerful feet; the bill is of moderate length, straight, and slender. The male has the upper part of the body dark brown, the throat and breast white, belly rusty. The dipper frequents streams, and feeds largely on water-insects and larvæ. It can dive and walk under water, effecting its progress by grasping the stones with its feet. The song is sweet and

lively. Other species are found in North Asia, America, and North Africa.

Dipping-needle, or Inclination Compass, an instrument for showing the direction of the earth's magnetic force. In essentials the instrument consists of a light magnetized steel bar supported on a horizontal axis which passes, as nearly as possible, through the centre of inertia of the bar. When a needle thus mounted is placed anywhere not in the magnetic equator, it dips or points downward; and if the vertical plane, in which it moves, coincides with the magnetic meridian the position of the needle shows at once the direction of the magnetic force. The angle between the magnetic axis and the dipping-needle and the horizontal is called the dip or inclination. This varies from 90° at the magnetic poles to 0° at the magnetic equator. The dip is 70° at Glasgow, and varies slowly with the passage of time. In the northern hemisphere, the north-seeking pole of the dipping-needle dips downwards, the reverse being the case south of the magnetic equator.

Diprotodon, a gigantic fossil marsupial, Pleistocene beds in Australia, allied to kangaroos. The skull is 3 feet long.

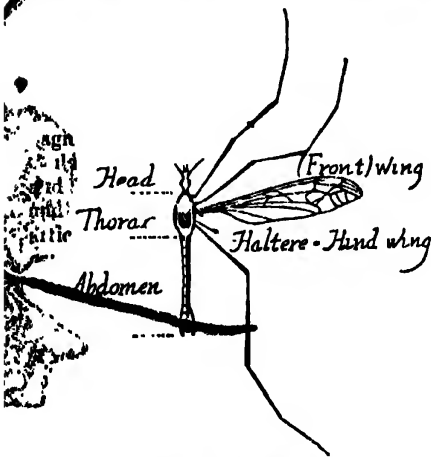
Dipsas, a genus of tree-snakes of which the species are native to tropical South America. Some of the hinder teeth in the upper jaw are grooved for the conduction of poison, but is not sufficiently deadly to be dangerous to human beings. The related genus *Dipsosaurus* includes a number of Indian species.

*Dipsomania* (Gr. *dipsa*, thirst, and *mania*, madness), a term used to denote an insane craving for intoxicating liquors, when occurring in a confirmed or habitual form. It is a form of acute alcoholism seen in persons with a strong hereditary tendency to drink. The only remedy appears to be seclusion, with enforced abstinence and healthy occupation. Homes for this purpose have been established in Britain under the Habitual Drunkards Act of 1879 and Inebriates Act of 1888. There are corresponding institutions in the United States.

Diptera, two-winged flies, an order of insects embracing a vast number of species, of which about 40,000 have been named. The two transparent wings correspond to the fore-wings of other insects, the hind-wings being often represented by small club-shaped structures (halteres or balancers). See diagram, p. 42. There are two large compound eyes, and the mouth-parts are often modified for piercing and sucking. There is a well-marked metamorphosis, the larvæ being usually limbless maggots. The Diptera include many agricultural and horticultural pests, and a number are notorious as disease carriers. See *Blow-fly*; *Bot-fly*; *Crane-fly*; *Fly*; *Gnat*; *House-fly*; *Midge*; *Mosquito*; *Tsetse-fly*.

**Dipteris**, a genus of *Leptosporangiate* ferns, section *Mixtae*, formerly included in *Polypodium*, but now recognized as the sole living genus of the *Dipteridinae*, a family which was largely developed in Mesozoic times. They are Indo-Malayan ferns with creeping rhizomes and long-stalked, fan-shaped, forked, leathery fronds.

**Dipterocarpaceae**, an important order of Asiatic dicotyledonous trees, allied to the *Malvaceae*. The different species produce a number of resinous, oily, and other substances; one, a sort of camphor; another, a fragrant resin used in temples; and others, aromatic resins; while some of the commonest produce



**Diptera**—Diagram of a two-winged insect—a Daddy-long-legs. Appendages of left side omitted

duce pitches, and *sal* (*Shorea robusta*) yields valuable timber.

**Diptych** (dip'tik), in Greek originally signified the same as *diploma*, something folded; the double tablets of metal, ivory, &c., used by the Greeks and Romans. Diptychs became important in the Christian Church, in them being written the names of Popes, and other distinguished persons, who had deserved well of the Church, to be mentioned in the church prayers. Diptychs also often contained pictures of biblical scenes.—Cf. Sir W. Smith, *A Dictionary of Greek and Roman Antiquities*.

**Dipyre** (dip'pir), or *Mizzonite*, a mineral—aluminum calcium sodium silicate—of the scapolite series. Its name indicates the 'double effect of fire upon it (Gr. *di*, double, *pyr*, fire) in producing first phosphorescence, and then fusion.

**Diræ**, one of the names under which the Eumenides were known to the Romans. See *Furies*.

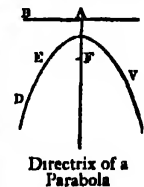
**Directors**, persons elected to meet together at short fixed intervals and consult about the

affairs of corporations or joint-stock companies, and to advise and assist the manager. These are termed *Ordinary Directors*, as in many companies there is a body called *Extraordinary Directors*, who have little or no business functions, and are chosen as a rule on account of their social position imparting a degree of distinction to the concern. Directors are appointed by a general meeting of the shareholders in the undertaking, and a certain number of them, usually a third, retire every year. Ordinary directors are granted a certain remuneration for their services. The duties and responsibilities of directors are defined by the constitution of the company, or by the various Acts of Parliament affecting joint-stock and other companies.

**Director'y**, the name given to a body of five officers to whom the executive authority in France was committed by the Constitution of the year III (1795). The two legislative bodies, called the *councils*, elected the members of the Director'y: one member was obliged to retire yearly, and his place was supplied by election. This body was invested with the authority which, by the Constitution of 1791, had been granted to the king. By the Revolution of the 18th Brumaire the Director'y and the Constitution of the year III were abolished. It was succeeded by the Consulate, with Napoleon as First Consul.

**Directrix**, a fixed line that is required for the description of a curve. The term is chiefly

used in connection with the parabola, ellipse, and hyperbola, which are the loci of points that move so that their distances from a fixed point (the focus) are in a constant ratio to their distances from the directrix. The directrix of a parabola is a line perpendicular to the axis produced, and at a distance from the vertex equal to the distance of the vertex from the focus. Thus  $AB$  is the directrix of the parabola  $VED$ , of which  $F$  is the focus.



**Dirk**, a kind of dagger formerly used as a weapon of offence by the Highlanders of Scotland. Dirks are worn by midshipmen and cadets of the Royal Navy, and still form part of the full Highland costume.

**Dirk-Hartog Island**, on the west coast of Australia, 45 miles long, north to south, and 10 miles broad.

**Dirt-beds**, in geology, layers of ancient soil, such as those in the Oolitic strata of the Isle of Purbeck (Dorset), which contain the stumps of trees that once grew in them.

**Disability**, in law, incapacity to do any legal act. It is either *absolute*, which wholly disables the person, such as outlawry or excommunication,

tion—or *partial*, such as infancy, coverture, insanity, or drunkenness.

**Disbarring, or Disbarments**, expelling a barrister from the Bar, a prerogative which, in England, is possessed by the benchers of each of the four Inns of Court. The party disbarred may lodge an appeal with the judges in their capacity of visitors.

**Disc, or Disk**, the central part of the capitulum of compositæ, surrounded by the ray. Also a part of a flower, sometimes cup-shaped, at the base of the stamens, consisting in some cases of rudimentary stamens, in others of the modified receptacle.—In astronomy the term is applied to the visible face or figure exhibited by the sun, moon, or a planet. In the case of the moon and certain planets it may be of gibbous, semicircular, or crescent form.

**Discharging Arch**, an arch formed in the substance of a wall to relieve the part which is



Discharging Arch

below it from the superincumbent weight. Such arches are commonly used over lintels and flat-headed openings.

**Discipline, Books of**, two books connected with the Church of Scotland. The *First Book of Discipline* was drawn up by John Knox and four other ministers, and laid before the General Assembly in 1560. Though not formally ratified by the Privy Council, it was secretly subscribed by the greater part of the nobility and barons who were members of the Council. Another similar document, the *Second Book of Discipline*, was prepared and sanctioned by the General Assembly of 1578, and has from that time been recognized as the authorized standard of the Church of Scotland in respect of government and discipline.

**Disclaim'er**, in its stricter legal sense, a plea containing renunciation or a denial of some claim alleged to have been made by the party pleading.

**Discomycetes**, a large section of the ascomycetous Fungi, distinguished by the fact that the hymenium covers the surface of an open, disc-like or cup-shaped fruit-body called an *apothecium*. It includes many important genera, such as *Dasycephala*, *Peziza*, and *Sclerotinia*.

**Disco'phora**, (1) a sub-class of the Hydrozoa,

comprising most of the organisms known as sea-jellies, jelly-fishes, and sea-nettles; (2) leeches (q.v.).

**Dis'count**, the charge made by a banker for interest of money advanced by him on a bill or other document not presently due. In advancing money on such a security the banker deducts the charge for interest on his advance from the total amount represented on the security, pays the difference, which is called the *proceeds* of the bill, to the person parting with it, and collects the full amount to reimburse himself for outlay and interest at maturity. Popularly the *discount* is applied to any deduction from the amount of an account made by the party to whom it is paid, especially on prompt or early payment. When a bill which has been *discounted* is paid by the acceptor before it is due, the discount allowed for prepayment is called *rebate*.

**Discov'ery**, in law, the act of revealing or making known any matter by a defendant in answer to a bill in chancery. The word is used in reference to the disclosure by a banker of his property for the benefit of his creditors, and to the right of a party to a lawsuit to obtain from his adversary, on oath, full disclosure of the facts within his knowledge, and production of the documents in his possession, relevant to the action.

**Discus, Disc, or Disk**, among the Greeks and Romans a quoit of stone or metal, convex on both its sides, sometimes perforated in the middle. The players aimed at no mark, but simply tried to throw the quoit to the greatest possible distance. It was sometimes furnished with a thong of leather to assist in the throwing. The thrower of the discus was called *discobolus*.

**Disease**, any morbid state of the body, or of any organ or part of the body. Diseases are described as local or constitutional, epidemic, endemic, contagious, acute, and chronic, according to the nature of their attack. The influence of the parents on the organization of the child is so great that not only peculiarities of external form, but the peculiar constitution, the greater or less activity and development of the organs, are found to pass from parent to child. As it is in the particular state of the several tissues and functions that certain diseases have their foundation, the liability to such affections is inherited with the organic structure, and children are not infrequently attacked by ailments from which one of their parents or grand-parents had previously suffered. In spite of the emphasis that has recently been put on the facts of heredity, the present tendency of preventive medicine holds out a larger hope by impressing upon us the fact that in such affections, for example, as tuberculosis and insanity, the individual's environment and personal history are perhaps more



potent than hereditary influence in the causation or the prevention of disease.

**Diseases of Plants.** See *Plant Pathology*.

**Disestablishment**, the severance of connection between Church and State, with the resultant emancipation of the Church from civil control, is a movement in which there has been considerable growth during the last half-century. The Church of the West Indies was disestablished in 1808, and all Colonial Churches, with the exception of the Church in India, are now free from State authority. In 1869 an Act, taking effect two years later, was passed for the disestablishment of the Church of Ireland, in which country the mass of the inhabitants are Roman Catholics. In France all recognition of Roman Catholicism as the State religion ceased in 1905, the French Government now tolerating all religions. In 1914 was passed a Bill for disestablishing the Church in Wales, though its effect was, owing to the war, deferred till 1920 by a suspensory Bill. The Church of Scotland has been practically free from State control since 1707, in which year patronage was abolished; the presence of the Lord High Commissioner, who represents the sovereign at the opening of the General Assembly, and the precedence enjoyed by the Moderator during his term of office, are little more than decorative courtesies. In a section of the English public there has been from time to time an agitation for the disestablishment of the Church of England; and the movement is even said to be viewed with favour by some advanced High Churchmen, who believe that it would result in increased freedom for the adoption of their special views; but, though a Disestablishment Society exists, there seems no immediate prospect of a decisive step in this direction.

**Dishonour of a Bill**, the refusal or neglect to accept or pay when due a bill of exchange, or promissory note, or draft on a banker. It is absolutely necessary that the holder of a dishonoured bill should give immediate notice of the non-payment to the drawer or endorsers.

**Disinfection**, the means employed for killing the germs of infectious or contagious disease by physical or chemical agencies. The former are the more important, and consist in applying water or steam at the boiling-point, or hot air at 160° C. Ten minutes' boiling, or half an hour in hot air, kills all ordinary disease germs, but a longer exposure is necessary to kill germs (especially those of putrefaction), which form spores (see *Bacteria*). The most important chemical agents are chlorine, iodine, carbolic acid, bleaching powder, Condy's red fluid (containing permanganate of potash), perchloride of mercury, formalin, and flavine. Carbolic acid is one of the most effective, needing, however, care in the

handling, as it is very poisonous and in strong solution causes severe burns. It does not in its common form mix with water, but solutions can be made by using hot water. A greater dilution than 1 part in 40 of water is useless as a disinfectant. For application to the skin, tincture of iodine is one of the readiest preparations. In cases of infectious disease the most important points are the immediate disinfection of all the excretions of the patient. Expectoration should be received into a sputum-cup containing 1-20 carbolic acid, and all handkerchiefs when soiled should be similarly treated. The personal linen and sheets of the patient should be placed in carbolic acid (1-40) in a slop-pail, and should be boiled before being sent to the laundry. All plates, spoons, &c., used for the patient's food, should be boiled or scalded immediately after use. The excretions of the bowels or kidneys should be treated with bleaching powder. Those in attendance should wear an overall when in the sickroom, and should wash the hands and face before coming into contact with anyone outside. They should wash out the mouth frequently with Condy as strong as can be tolerated. Their linen should be treated in the same way as that of the patient. At the close of the illness all bedding should be baked in the hot-air oven which most local authorities now provide for the purpose. Everything washable in the sickroom should be washed with soft soap, and it is better that the room should be repapered.

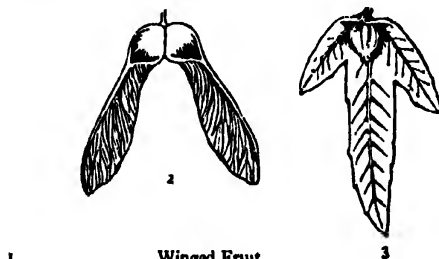
**Disintegrator**, a machine for pulverizing and sometimes for mixing various materials, such as rock, asphalt, ore, artificial manures, sugars, corn, and the ingredients of mortar.

**Dislocation**, a surgical term applied to cases in which the articulating surfaces of the bones have been forced out of their proper places. The particular dislocation takes its name either from the joint itself or its farthest bone, and is called *compound* when accompanied by an external wound. The most common dislocations are those of the hip, shoulder, elbow, knee, and ankle, and the chief obstacle to their reduction is the spasmodic and violent contraction of the muscles consequent upon them, the application of considerable force being often necessary to set the joint. Chloroform is of great use, not only in preventing pain but in relaxing the muscles. The most dangerous dislocations are those of the bones of the spine.—In geology it signifies the displacement of parts of rocks or portions of strata from the situations they originally occupied.

**Dismal Swamp**, a large tract of marshy land in America, beginning a little south of Norfolk, in Virginia, and extending into North Carolina, containing 150,000 acres; 80 miles long, from

north to south, and 10 miles broad. This tract was entirely covered with trees, with almost impervious brushwood between them, but it has now in part been cleared and drained. In the midst of the swamp is a lake, called *Drummond's Pond*, 7 miles in length. A navigable canal through the swamp connects Chesapeake Bay and Albemarle Sound.

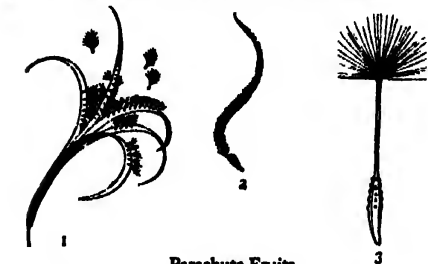
Dispensation is the act by which an exception is made to the rigour of the law in favour of some person. The Pope may release from all oaths or vows, and may sanction a marriage within the prohibited degrees of the Mosaic law, or exempt from obedience to the disciplinary



1, Ash. 2, Sycamore. 3, Hornbeam.

enactments of the canon law. In England the monarch claimed, in former times, a similar dispensing power in civil law, but the prerogative was so much abused by James II that it was abolished by the Bill of Rights. The power of commuting sentences in capital cases is the only form in which the dispensing power of the Crown still exists. In ecclesiastical matters a bishop may grant a dispensation allowing a clergyman to hold more than one benefice, or to absent himself from his parish.—Cf. F. W. Maitland, *Constitutional History of England*.

Dispersal of Seeds and Fruits serves (a) to scatter these reproductive structures and so



1, Ripe fruit of willow-herb, dehiscing. 2, Single fruit of clematis. 3, Single fruit of dandelion.

reduce internecine competition; (b) to bring the seeds into new surroundings, which may be more favourable than those of the parent plant. The chief agents of dispersal are wind and

animals. Very minute seeds, like those of orchids, are carried away by the gentlest air-currents. Larger wind-borne seeds are winged, as in the pine, most Bignoniaceæ, &c.; or provided with a tuft of hairs acting as a parachute, as in willow, willow-herb, cotton, &c. Winged fruits are exemplified by ash, elm, sycamore,



1, Geum and single fruit. 2, Burdock.

many docks, &c.; parachute fruits by Compositæ, Clematis, cotton-grass, &c. In the case of animal dispersal, the whole fruit is usually involved, being either edible, with hard ingestible seeds which are cast up or voided the excreta (fleshy fruits), or hooked so as to stick to fur or wool, as in bidens, cleavers, evening primrose, nightshade, and other 'burs'. A small number of



Explosive or Sling Fruits

1, *Echallium Elaterium*, flowers and fruit, one fruit detached from its stalk with its seeds squirting out. 2, *Oxalis Acetosella*, entire plant, with one unripe fruit on a hooked stalk, and one ripe fruit on an erect stalk ejecting its seeds. 3, Ripe fruit of *Oxalis Acetosella* ejecting the seeds (enlarged).

of fruits and seeds, such as the coco-nut and the seeds of water-lilies, are adapted for water transport. In certain cases seeds are scattered for short distances by an 'explosive' mechanism, as in wood-sorrel, impatiens, sand-box tree, squirting cucumber, and other 'sling' fruits.

Dispersion, in optics, the angular separation of light rays of different colour, that is, of different wave-length. Dispersion may be caused either by refraction or by diffraction. When



beam of composite light passes obliquely from air into a second transparent medium, each constituent of the light is bent or refracted through a different angle from the original direction of the beam, with the result that the different colours are separated fanwise, or dispersed at the surface of the second medium. In the refraction spectrum of white light, when caused by passage through a glass prism, the red rays are least deviated and the violet rays most deviated, if we consider only the visible spectrum. The difference of the angles of deviation for two selected rays measures their dispersion, and if this angle is divided by the deviation of the mean ray, we obtain the dispersive power of the prism. Transparent media vary in their dispersive powers; for example, carbon disulphide has more than three times the dispersive power of crown glass. The true nature of dispersion was first demonstrated by Newton, who concluded that the colours of the spectrum were homogeneous and caused by the vibrations of definite wave-length, the different colours being unequally refrangible. Newton was, however, led to the erroneous conclusion that the dispersion was proportional to the refraction. This was later disproved by the construction of achromatic lenses, or lenses which caused deviation without dispersion, and direct-vision spectroscopes, or instruments which caused dispersion with no deviation of the central part of the spectrum. The dispersive power is not the same for all parts of a refraction spectrum; besides, the same colours do not occupy the same positions in spectra formed by prisms of different material. This arises from the fact that there is no simple relation between the deviation of a ray and its wave-length; consequently, such spectra are called irrational, and the property is known as the irrationality of dispersion. In the diffraction spectrum, the order of the colours is reversed, red undergoing the greatest deviation; also, the deviation for a given colour is nearly proportional to the wave-length. The diffraction spectrum is therefore termed a normal spectrum.

All substances do not give the same order of colours in their spectra; certain exceptions are known in which the usual order of the colours is changed. Christiansen showed that an alcoholic solution of fuchsin gave a spectrum containing only violet, red, and yellow; the violet is least refracted, and the yellow most, and a dark band lies between the violet and the red. This has been called anomalous dispersion, and similar effects have been observed in iodine and sodium vapours, and in solutions of colours derived from aniline which exhibit surface colour.

The theory of dispersion now generally accepted is that of Sellmeier, which was published

in 1871. Sellmeier assumed that when light waves pass through a material substance, they set the particles of the substance in vibration, and these resonant vibrations react in such a way as to modify the velocity with which the waves are transmitted. Applying the dynamical principles of wave motion to the case of an elastic solid in which heavy particles are embedded, Sellmeier obtained an equation which connected the refractive index of the substance with the wave-length of the incident light. Equations of similar form were subsequently derived by Ketteler and Helmholtz. The consideration of Sellmeier's equation leads to important conclusions. If the period of vibration of the incident waves is very short, as compared with those of the particles forming the solid, no refraction will take place, and the rays will travel through the solid without deviation and without change of velocity. This is verified in the case of X-rays, which consist of extremely short waves and which are not deviated on passing through light-opaque solids. Sellmeier's equation may also be modified to apply to the case of anomalous dispersion. The phenomenon is always associated with absorption of light of a particular wave-length or range of wave-lengths, and the conclusion is drawn that the medium will possess an abnormally high refractive index for waves slightly longer than those which it absorbs, and an abnormally low index for waves slightly shorter than those which it absorbs. This result has been verified by various investigators. Rubens has determined the values of the constants in Sellmeier's equation for rock-salt, sylvine, fluor-spar, and quartz, and has shown that the equation gives correct values for the refractive indices of these substances over the entire range of wave-lengths to which they are transparent.—BIBLIOGRAPHY: T. Preston, *Theory of Light*; E. Edser, *Light for Students*; P. Drude, *Theory of Optics*.

**Displacement.** The position of a point in space is fixed by means of its distances  $x, y, z$ , from three mutually rectangular planes. If the point moves to another position, it is said to be displaced, and the rates of displacement parallel to these planes measure the velocities  $\frac{dx}{dt}, \frac{dy}{dt}, \frac{dz}{dt}$ , parallel to these planes. If the acting forces be resolved in directions parallel to these planes, relations may be found between the forces, the accelerations parallel to the planes and the mass of the body. These relations are called the equations of motion. In hydrostatics a body immersed in a liquid displaces a certain volume of the liquid, and the upthrust of the liquid in the body is, by the principle of Archimedes, equal to the weight of liquid displaced. It follows

that, in the case of a floating ship, the weight of the ship is equal to the weight of water displaced. This weight is called the displacement of the ship, and is measured in tons.

**Disposition**, in Scots law, is, in its general acceptation, a deed by which a person provides for the general disposal of his property heritable and movable, after his death, equivalent to a will or testament; also a conveyance of property.

**Disraeli**, Benjamin. See *Beaconsfield*.

**D'Israeli** (diz-rä'e-li), Isaac, man of letters, and father of the well-known statesman, was born at Enfield, Middlesex, in 1760, died in 1848. His father, Benjamin D'Israeli, a descendant of a family of Spanish Jews which had settled at Venice in the fifteenth century to escape the Inquisition, came over to England in 1748 and made a large fortune. Isaac D'Israeli, however, showed a strong repugnance to commerce, and was finally permitted to follow his literary bent. An anonymous reply to Peter Pindar, entitled *On the Abuse of Satire*, was followed during 1791 to 1793 by the appearance of his *Curiosities of Literature*, the success of which determined much of his afterwork. His *Essay on the Literary Character* was published in 1795, and some time afterwards a volume of romantic tales, *The Loves of Mejnoun and Leila*. Between 1812 and 1822 appeared his *Calamities of Authors*, *Quarrels of Authors*, and *Inquiry into the Literary and Political Character of James I*; the three being afterwards published collectively under the title of *Miscellanies of Literature*. In 1828 appeared the commencement of his *Life and Reign of Charles I*, a work completed in 1831. An affection of the eyes put an end to a projected *Life of Pope* and a *History of English Freethinkers*, but in 1841 he published a selection from his MSS. under the title of *Amenities of Literature*. The greater part of his life was passed in his library. For his son, see *Beaconsfield*.

**Disruption**, the name commonly applied in Scotland to the act by which, in 1843, 474 ministers and professors of the Established Church gave up their livings to vindicate principles which they held to be essential to the purity of the Church, and in harmony with its earlier history. See *Free Church*.

**Diss**, a town, England, Norfolk, on the slope of a hill 18 miles south by west of Norwich. It was formerly noted for the manufacture of 'Suffolk hempen cloth', worsted yarn, and knit hosiery. Pop. 3763.

**Dissection**, a word, derived from Latin, that is etymologically equivalent to the word *anatomy*, derived from Greek. Its literal meaning is 'cutting up', and it is used to define the technical procedures for acquiring a practical knowledge of the anatomy or structure of the body. Dissection of the human body is an essential part

of the education of a medical practitioner, for it is the only means whereby he can acquire a thorough and practical familiarity with the geography of the territories in which all his professional activities lie. Therefore the medical student is required thoroughly to explore every part of the human body, to examine all its constituent parts, to learn to recognize their properties, positions, and relationships, and to train his eyes and fingers to appreciate their distinctive qualities. This process of exploration usually occupies about eighteen months or more of the student's time; but it represents the foundation upon which all his professional knowledge and experience are built up. For this purpose it is of the utmost importance that he be provided with ample facilities for acquiring the training which is essential to the medical practitioner. But the supply of subjects for dissection is difficult to acquire. Until a century ago teachers in medical schools, being unable to get an adequate supply of bodies for dissection by legal means, were forced to deal with 'snatchers' who plundered cemeteries. Even the terrible scandals associated with the names of Burke and Hare forced the Government to pass an Anatomy Act to make better provision for this necessary part of medical education. Within recent years the action of the House of Lords has so hampered the administration of the Act that teachers in medical schools are threatened with the same dilemma as their colleagues a century ago had to face. The Guardians of the Poor in some localities prefer to bury the unclaimed bodies of the dead at the ratepayers' expense rather than allow them to be used for the necessary instruction of surgeons and physicians. Offers are repeatedly made by men and women, often well-known and distinguished people like the late Miss Florence Nightingale, to place their bodies at the service of medical education; but in accordance with the law of the land such bequests are invalid, because once a person is dead the corpse is not his property but belongs to his relatives. Hence it is only the unclaimed bodies that are legally available for dissection.

**Dissel'zin**, or **Disseizin**, in law, is the dispossessing one of a freehold estate, or interrupting his *seizin*. Of freeholds only can a *seizin* be had, or a *disselzin* done. Whether an entry upon lands is or is not a *disselzin*, will depend partly upon the circumstances of the entry, and partly upon the intention of the party as made known by his words or acts.

**Dissent'ers**, the common name by which in Britain all Christian denominations, excepting those of the Established Churches, are usually designated, though in Acts of Parliament it generally includes only Protestant dissenters.

Roman Catholics being referred to under their specific name. The most important bodies of English dissenters are the different bodies of Methodists, the Congregationalists, and the Baptists; and of Scottish dissenters, the United Free Church and the Free Church. The Non-conformists were dissenters from the English Church, and the name is sometimes used as meaning simply dissenters, though it has properly a wider meaning.

**Dissentis**, a Swiss town, canton of Grisons, 3800 feet above the sea, at the junction of the Middle and Vorder Rhine, with a Benedictine abbey established so long ago as A.D. 614. Pop. 1420.

**Dissociation**. Certain substances tend to break down into simpler substances with change of temperature; thus ammonium chloride on heating gives a mixture of hydrochloric acid (HCl) and ammonia (NH<sub>3</sub>), and on cooling these substances recombine to give ammonium chloride (NH<sub>4</sub>Cl) again. Dissociation is therefore a particular case of decomposition, where the products of decomposition recombine on obtaining the original conditions.

**Dissonance**, in music, that effect which results from the union of two sounds not in accord with each other. The ancients considered thirds and sixths as dissonances; and, in fact, every chord except the perfect concord is a dissonant chord. The old theories include an infinity of dissonances, but the present received system reduces them to a comparatively small number. The most common are those of the tonic against the second, the fifth against the sixth, or (the most frequent of all) the fourth against the fifth.

**Distaff**, the first instrument employed in spinning. It consisted of a staff, on one end of which the wool or flax was rolled. The spinner held it in the left hand, and drew out the fibres with the right, at the same time twisting them. A small piece of wood called a spindle was attached to the thread, the weight of which carried it down as it was formed. When the spindle reached the ground, the thread which had been spun was wound round it, and it was then again fastened near the beginning of the

new thread. In ancient and modern art the Fates are usually represented with the distaff, engaged in spinning the thread of life.

**Distemper**, a disease of the dog commonly considered as of a catarrhal nature. In most cases a running from the nose and eyes is one of the first and chief symptoms, the defluxion becoming after some time mucous and purulent. The animal is subject to violent fits of coughing combined with vomiting, loses its appetite, its flesh begins to waste, and if the disease be virulent, symptoms of affection of the brain manifest themselves, accompanied by fits, paralysis, or convulsive twitchings. In the first stage of the disease laxatives, emetics, and occasional bleeding are the principal remedies; diarrhoea should be checked by astringents, and to reduce the violence of the fits warm bathing and antispasmodics should be resorted to. The distemper is generally contagious, and occurs but once in a lifetime.

**Distemper** (It. *tempera*), in painting, a preparation of colour mixed with size, yolk of egg or white of egg. Prepared with size, it is used chiefly in scene painting and household decorations, but in other forms it is much used for easel and mural paintings. Before the introduction of oil as a medium in the fifteenth century, fresco and distemper were the principal methods of painting. Distemper is usually but not necessarily applied to a dry ground, fresco always to a wet.

**Distich** (dis'tik), a couplet of verses, especially one consisting of a Latin or Greek hexameter and pentameter, making complete sense. Distichs have been frequently made use of by the modern German poets.

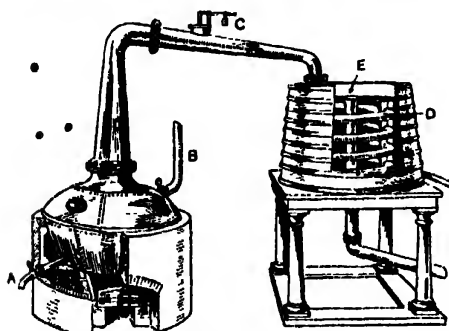
**Distillation**, the volatilization and subsequent condensation of a liquid in an apparatus known as a *still* and heated by a fire or flame. The operation is performed by heating the crude liquid or mixture in a retort or vessel known as the *body of the still*. This is made of various shapes and materials, and is closed, with the exception of a slender neck which opens into the condenser, a long tube through which the hot vapour from the still is passed. The tube is kept at a sufficiently low temperature to cause the vapour to condense, the common method of securing this being to surround the tube with a constantly renewed stream of cold water. In some cases ice or a freezing mixture may be required to effect condensation. In a large-scale apparatus the condensing tube is coiled round and round in a tub or box, and is known as a *worm*. From the end of it the vapour condensed into a liquid drops into a receiver. The simplest case of distillation is that of water containing solid matter in solution, the solid matter remaining behind in the still or retort while the water



A, Distaff. It is shown held by the waist-belt of the spinner. The spindle is revolving and twisting the wool.

## DISTILLATION

trickles pure into the receiver, through a worm made of block-tin, as most other metals are attacked by distilled water. When the mixture to be distilled consists of two or more liquids of different boiling-points, such as alcohol and water, the more volatile comes off first, accompanied by a certain proportion of the vapour of the other, so that it is hardly possible completely to separate bodies by one distillation. This is effected by repeated successive distillations of the liquid with or without the addition of substances to retain the impurities. When the



Distillation of Alcohol

A, Emptying pipe. B, Wash inlet. C, Vacuum safety valve. D, Worm. E, Cooling water inlet.

production of one of the ingredients only is aimed at by this process, it is called *rectification*, but when it is desired to separate and collect all the liquids present, or to divide a mixture into portions which volatilize within certain ranges of temperature, the process is called *fractional distillation*. In the laboratory, distillation is employed for purifying water, for recovering alcohol and ether, and for the preparation, purification, and separation of a great number of bodies. Substances which decompose at their boiling-points can be distilled under reduced pressure. On the large scale distillation is employed in the preparation of potassium, sodium, zinc, mercury; of sulphuric acid, ether, chloroform, carbon bisulphide, essential oils and perfumes; in the purification of coal and wood tar, and the products obtained from them; and on an extensive scale in the manufacture of whisky, brandy, or other spirit. The distillation of whisky has long been familiar in Britain, especially in Scotland and Ireland, and, when performed by means of the old *pot-still*, is a simple operation indeed, and one that even yet is practised surreptitiously in out-of-the-way localities. On the large scale a more elaborate apparatus is employed, and for alcohol of a cheap class Coffey's or other patent still is much used. Copper is the metal that suits best

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as the material for the stills used in distilling whisky. Sea-water is distilled in many cases for drinking or cooking purposes. This water is, of course, very pure, but its taste is far from agreeable. *Destructive distillation*, or *dry distillation*, differs from the preceding in this respect, that the original substance is not merely broken up into bodies by the mixture of which it is formed, but is so treated that it is further decomposed, and products are obtained which were not present uncombined in the original material. (See *Coal-tar*.) The term is restricted to the action of heat upon complex organic substances out of contact with the air. The products of destructive distillation are numerous and varied. On the manufacturing scale the process is conducted sometimes for the sake of one part of the products, sometimes for the sake of another. Coal, for example, may be distilled not solely for the gas, but also for ammoniacal water, benzene, anthracene, as well as for the sake of the fixed carbon or coke, the volatile portions being too often neglected and practically wasted. But much more economical methods of making coke are now practised than formerly. Wood is distilled partly for the sake of the pyroligneous acid and the tar, partly for the charcoal, though the gas is also collected. Shale is distilled both for the oil and for the paraffin wax, ammonia, &c., obtained.

**Distinguished Conduct Medal**, a medal instituted in 1854 under the name of the Meritorious Service Medal as "a mark of the Sovereign's sense of the distinguished service and gallant conduct in the field of the army then serving in the Crimea". The regulations concerning this medal were revised in 1892, when it received its present name. It is given to warrant-officers, non-commissioned officers, and privates. As from the 1st Aug., 1918, the medal is awarded for services in action only. The medal is silver, 1·4 inches in diameter; on the obverse is the Sovereign's head, and on the reverse the inscription "For Distinguished Conduct in the Field". It is suspended from a ribbon 1½ inches wide, crimson, blue, and crimson, the colours being of equal width. Bars may be awarded for additional deeds of gal-



Distinguished Conduct Medal

lantry; in service uniform the possession of a bar is indicated by a silver rosette worn on the ribbon. The letters D.C.M. are placed after the name of the recipient, who receives either a gratuity of £20 on discharge, or an increase in pay of 6d. a day.

Distinguished Flying Cross, a decoration instituted during the European War, and



On Left, Distinguished Flying Cross (obverse)  
On Right, Distinguished Flying Medal (obverse)

awarded to officers and warrant-officers of the Air Force for acts of gallantry when flying active operations against the enemy. The ribbon is 1½ inches wide, and has narrow purple and white alternate diagonal stripes. The letters D.F.C. are placed after the name of the recipient. A corresponding medal, the Distinguished Flying Medal, is awarded to non-commissioned officers and men.

Distinguished Service Cross, a naval decoration formerly known as the Conspicuous Service Cross, and instituted in 1901. It is awarded to naval officers below the rank of lieutenant-commander, and to warrant-officers, for services before the enemy. The ribbon is dark-blue, white, and dark-blue, in stripes of equal width. The letters D.S.C. are placed after the name of the recipient.

Distinguished Service Order, The, was instituted by Royal Warrant on 6th Sept., 1886. All commissioned officers of the Navy, Army, or Air Force are eligible to be appointed Companions of this Order. It is conferred upon officers who have been specially mentioned in dispatches for meritorious or distinguished services. Towards the end of the European



Distinguished Service Cross (obverse)

War (1st Aug., 1918) it was decided that this decoration was only to be given for services in action, i.e. (1) for service under fire, or (2) distinguished individual service in connection with air-raids, bombardments, or other enemy action. Bars may be awarded for additional deeds of gallantry; in undress uniform the possession of a bar is indicated by a silver rosette worn on the ribbon. The ribbon is red, edged with blue, and is 1 inch wide. It is the same as the ribbon of the Waterloo and Peninsular medals, only narrower. The badge of the order is a gold cross *palée* enamelled white, edged gold, having on one side thereof, in the centre, within a wreath of laurels enamelled green, the Imperial Crown in gold, upon a red enamelled ground, and on the reverse, within a similar wreath and on a similar red ground, the Imperial and Royal cipher (G.R.I.) The letters D.S.O. are placed after the name of the recipient, who ranks between Commanders of the Order of the British Empire and Members of the Royal Victorian Order (4th class).



Distinguished Service Order (obverse)

Dis'tomum, a genus of trematode or suckorial parasitic worms or flukes, infesting various parts in different animals. *D. hepaticum*, the common liver fluke, when adult inhabits the gall-bladder or ducts of the liver in sheep, and is the cause of the disease known as the rot. It may also occur in ox and man. In form it is ovate, flattened, and presents two suckers (whence the name), of which the anterior is perforated by the aperture of the mouth. The digestive tube divides into two branching halves, the excretory organs consist of delicate branching tubes, and there is a complex set of hermaphrodite reproductive organs. The minute larvæ live in a small water-snail (*Limnæa truncatula*), from which they ultimately escape to encyst on grass, &c., by which sheep may become infested. The adults of other species of Distomum live within the bodies of various fishes, amphibia, reptiles, birds, and mammals.

Distress' (Lat. *distingere*, pull asunder), in law, is the taking of a personal chattel of a wrongdoer or a tenant, in order to obtain satisfaction for the wrong done, or for rent or service due. If the party whose goods are seized disputes the injury, service, duty, or rent, on account of which the distress is taken, he may replevy the things taken, giving bonds to return them or pay

damage in case the party making the distress shows that the wrong has been done, or the service or rent is due. Wrongful distress is actionable. Another kind of distress is that of *attachment*, to compel a party to appear before a court when summoned. The distresses most frequently made are on account of rent and taxes and *damage-feasance*.—Cf. Blackstone, *Commentaries on the Laws of England*.

Distribution is that part of the subject-matter of economics which deals with the division, among the individuals composing a community, of the product of their labour and of land and capital at their command. It is the most contentious part of economics, as well as that which has most social interest and importance, for in it there is a sharper conflict than anywhere else between economic considerations and ideals of social justice, and the problem is to secure such a distribution as will satisfy social justice, without abandoning the incentive to effort provided by the possibility of a greater reward.

The present position is one of unresolved discord between the economic and the equalitarian schools. The economic analysis is based upon a division of the factors of production into three, viz. Labour, Capital, and Land. These are represented as competing among themselves for employment, which is given to each in accordance with the return which will be secured as a result of an addition to the amount already employed; the rewards of each fall roughly under the headings of Wages and Salaries, Interest and Rent, respectively. The demarcation cannot be exact, as much that in common life is regarded as interest on capital partakes really of the nature of wages, as being earnings of management or reward for risk-taking, while certain forms of capital, whose quantity is temporarily fixed, may receive a return which is more of the nature of rent.

The fundamental assumption of the economists is that competitive distribution is indispensable, both in order to secure a fruitful distribution of the resources and efforts of society between the three factors of production, and also owing to the need of an incentive to keep individuals working hard enough to ensure a supply of goods sufficient to maintain and improve the standard of life of the community. Economists do not assume that men would not work at all if they were guaranteed a living wage whether they did or not, but that men would not work enough, and would be guided in the direction of their efforts by personal idiosyncrasy rather than by the needs of the community. The only alternatives to a great falling off in national wealth are, in their view, either competitive distribution or enforcement of work by

a rigid discipline, which would be as hard as the present system, while being less adaptable.

Against this analysis idealist thinkers rebel, on the ground that it fails to justify the great inequality in the distribution of wealth between different individuals and classes of society. Their protest dates from the harsh dogmatism of the economists who propounded the now discredited 'Iron Law of Wages' and 'Wages Fund Theory', which both consigned wage-earners to lives of unremitting toil for a reward inevitably limited to a very small amount. Against these views appeal is made to justice and equality, and the result is summed up in the phrase 'to each according to his needs, from each according to his ability', i.e. the community should be so organized that each member receives that which he needs, while giving in return work according to the best of his ability. An alternative and cruder theory is that which demands absolute equality in the distribution of wealth. The economic basis for these theories is the claim that all production is the result of labour, and that the workers are entitled to the 'whole produce of their labour', interest and rent being 'surpluses' appropriated by the capitalist owing to the exploited workers being kept at the level of subsistence. The economic statement of the case is generally associated with the name of Marx, who was, however, greatly influenced by English writers; but the driving force of the movement is moral and emotional.

District Courts, an important series of courts in the United States, each under a single judge, and having original jurisdiction in civil, criminal, and admiralty causes. Generally there is one for each state. By the Judiciary Code, enacted by Congress in 1911, the circuit courts, which had hitherto shared original jurisdiction with the district courts, became only appellate tribunals.

*Distringas* (Lat., that you distrain), a notice proceeding upon an affidavit filed in the High Court by a party not the registered holder of shares or stock but beneficially interested therein, and served upon the particular company or public body, whereby it is precluded from registering any transfer of the shares or stock or any mandate for payment of the dividends without previous intimation to such party. The latter has thus the opportunity, if desired, to apply for an interim injunction, and, should he not do so within eight days from the date upon which the transfer or mandate was lodged, the restraint flies off.

*Dithyrambus*, or *Dithyramb*, in Greek literature, a poem sung in honour of the god Bacchus or Dionysus, at his festivals. The choral portion of Greek tragedy arose out of the



dithyramb. It was composed in a lofty and often inflated style: hence the term is applied to any poem of an impetuous and irregular character.

**Ditmarsches** (Ger. *Dithmarschen*), a district of Holstein, in Germany, consisting of a monotonous flat stretching along the North Sea, between the mouths of the Elbe and the Eider, and so little raised above the sea as to require the protection of strong embankments. Ditmarsches was incorporated in Prussia in 1806. The area is 500 sq. miles, and the total pop. 96,373.

**Dit'tany**, the popular name of the plants of the genus *Dictamnus*, an herb of the rue family (*Rutaceæ*), found in the Mediterranean region. The leaves are pinnate, the large white or rose-coloured flowers are in terminal racemes. The whole plant is covered with oily glands, and the secreted oil is so volatile that in hot weather the round the plant becomes inflammable. *D. sinella* and *D. albus* are found in gardens. **Dittay**, in Scots law, a technical term signifying the matter of charge or ground of indictment against a person accused of a crime; also, the charge itself.

**Diuretics** are agents used to increase the flow of urine. Many drugs are used for this purpose: caffeine and theobromine, digitalis and squinanthine, potassium salts, carbonates, calomel and blue pill.

**Divan'**, a Persian word having several significations. It is used in Turkey for the highest Council of State, the Turkish ministry; and for a large hall for the reception of visitors. Low couches, covered with rich carpets and cushions, are ranged along the walls of the room. Hence in Western Europe the term is applied to a café, and to a kind of cushioned seat. In India the term is applied to the Prime Minister of a native State. Among several Oriental nations this name is given to certain collections of lyric poems by one author. The *divans* of Hafiz and Saadi, the Persian poets, are among the most important.

**Divergent**, in algebra, opposed to convergent, a term applied to an infinite series which cannot be said to have a sum because there is no definite limit towards which the sum of its terms tends as the number of terms is increased indefinitely.

**Divers**, birds remarkable for the habit of diving. The divers (*Colymbidæ*) are a family of swimming birds, characterized by a strong, straight, rather compressed pointed bill about as long as the head; a short and rounded tail; short wings; thin, compressed legs, placed very far back, and the toes completely webbed. They prey upon fish, which they pursue under water, making use partly of their wings, but chiefly of their legs and webbed feet in their

subaqueous progression. The leading species are the great northern diver (*Colymbus glacialis*), the red-throated diver (*C. septentrionalis*), and the black-throated diver (*C. arcticus*). These birds inhabit the Arctic seas of the New and Old Worlds; they are abundant in the Hebrides, Norway, Sweden, and Russia. The great northern diver, loon, or ember goose is about 2½ feet long, and is of handsome plumage.

**Div'idend**, literally what is to be divided, a term used in arithmetic and in reference to stocks. In the latter sense it is the interest or profit of stocks divided among, and paid to, the proprietors. No dividend must be paid except out of profit (Companies Act of 1892). The term also signifies the payment made to creditors out of the estate of a bankrupt.

**Dividing Engine**, a machine for marking the



Red-throated Diver (*Colymbus septentrionalis*)

divisions on the scales of scientific, mathematical, or other instruments. Some of these perform work of extraordinary fineness and accuracy. It may also be employed to measure lengths accurately, or to divide a given length into any number of equal or unequal parts. See *Graduation*.—Cf. Stewart and Gee, *Practical Physics* (vol. i).

**Dividing Range**, Great, an Australian chain of mountains, forming the watershed between the rivers flowing into the Pacific and those running westward. It is situated at an average distance of 80 miles from the sea, though in some places it recedes as much as 60 miles, and stretches from Cape York on the north to Wilson's Promontory on the south. The culminating point is Mount Townshend (7353 feet).

**Divi-divi**, the pods of *Cæsalpinia coriaria*, a tree which grows in tropical America, and a member of the family which yields sapan, brazil, and other red woods. The pods are about 1 inch broad and 8 inches long, but are generally bent or curled up; are excessively astringent, containing a large proportion of tannic and gallic acid, for which reason they are used by tanners and dyers.

**Divination**, the act of divining; a foretelling

future events, or discovering things secret or obscure, by the aid of superior beings, or by other than human means. Cicero divided it into two kinds, *natural* and *artificial*, or *intuitive* and *inductive*. *Natural* divination was supposed to be effected by a kind of inspiration or divine afflatus; this method of divination is familiar as represented by oracles; *artificial* divination was effected by certain rites, experiments, or observations, as by sacrifices, observation of entrails and flight of birds (ornithomancy), of the behaviour of fishes (ichthyomancy), lots, omens, and position of the stars. Among modes of divination were: *axinomancy*, by axes; *belomancy*, by arrows; *bibliomancy*, by the Bible; *oneiromancy*, by dreams; *pyromancy*, by fire; *hydromancy*, by water; *coscinomancy*, by observing the results of the turning of a sieve hung on a thread. Cf. Bouché-Leclercq, *Histoire de la divination dans l'antiquité*.

**Divine Right**, the claim set up by some sovereigns or their supporters to the absolute obedience of subjects as ruling by appointment of God, inasmuch that, although they may themselves submit to restrictions on their authority, yet subjects endeavouring to enforce those restrictions by resistance to their sovereign's acts are considered guilty of a sin. This doctrine, which came into general use in the seventeenth century, and is so celebrated in English constitutional history, especially in the time of the Stuarts, may now be considered to be exploded. Hobbes was one of the chief supporters of the theory of Divine Right, whilst Milton was a strong opponent. Cf. J. N. Figgis, *Theory of the Divine Right of Kings*.

**Divine Service, Tenure by**, a species of tenure, now obsolete, by which the tenant held the land on condition of performing some divine service, such as saying so many masses or distributing a certain amount in alms.

**Diving**, the art or act of descending into the water to considerable depths, and remaining there for a time. The uses of diving are important, particularly in searching for pearls, corals, sponges, examining foundations of bridges, salvage of wrecked ships, recovering valuables, clearing propellers, valves, and cleaning bottoms of ships when no dry docks are available. Without the aid of artificial appliances a skillful diver may remain under water for two, or even three minutes; accounts of longer periods are doubtful or absurd. Various methods have been proposed, and engines contrived, to render diving more safe and easy. The great object in all these is to furnish the diver with fresh air, without which he must either make but a short stay under water or perish.

**Diving-bell**, a contrivance for the purpose of enabling persons to descend and to remain

below the surface of water for a length of time, for various purposes, such as laying foundations of bridges, blasting rocks, and recovering treasure from sunken ships. Diving-bells have been made of various forms, more especially in that of a bell or hollow truncated cone, with the smaller end closed, and the larger one, which is placed lowermost, open. The air contained within these vessels prevents them from being filled with water on submersion, so that the diver may descend in them and breathe freely for a long time, provided he can be furnished with a new supply of fresh air when the contained air becomes vitiated by respiration. The diving-bell is usually made of cast iron, and weighted, and has several strong convex lenses set in the sides or roof, to admit light to the persons inside. It is suspended by chains from a barge or lighter, and can be raised or lowered at pleasure upon signals being given by the persons within, who are supplied with fresh air pumped into a flexible pipe by means of force-pumps carried in the lighter, while the heated air escapes by a tube in the upper part of the bell. Modern diving-bells are usually rectangular in shape, and have a trunk or tube on top reaching to the surface of the water, and fitted with an air-lock to enable men to go into or out of the bell without moving it from the bottom; they are fitted with telephones and electric lights. A constant flow of fresh air is kept up, and all excess of air escapes from the lower part of the bell, the pressure of the air being kept slightly above that of the water outside. The diving-bell has long been found highly useful for carrying on work under water, a steam-crane being usually employed for the movements required. A form, called the *nautilus*, has been invented which enables the occupants, and not the attendants above, to raise or lower the bell, move it about at pleasure, or raise great weights with it and deposit them in any desired spot.

**Diving-dress**, a waterproof dress of india-rubber cloth used by professional divers, and covering the entire body except the head. The dress has a neck-piece or breastplate, fitted with a segmental screw bayonet joint, to which the head-piece or helmet, the neck of which has a corresponding screw, can be attached when wanted. The helmet has usually three eyeholes, covered with strong glass, and protected with guards. Air is supplied by means of a flexible air-pipe which screws on to a non-return valve on the helmet, and is connected with an air-pump on the surface. To allow of the escape of excess air a valve is fitted in the helmet, so constructed as to prevent water getting in, though it lets the air out. It can be adjusted by the diver to suit his convenience, no matter at what depth he may be. Lead weights are attached to the diver,



and his boots are weighted, so that he can descend a ladder and walk about on the bottom. Communication can be carried on with those above by signals on the breast-ropes between the diver and his attendant, or he may converse with them through a speaking-tube or by telephone, which is usually fitted in the breast-ropes. One form of diving-dress makes the diver independent of any connection with persons above water



1, Ordinary diving-dress with (2) helmet. 3, Front view and (4) back view of self-contained diving apparatus.

Reproduced by courtesy of Messrs. Siebe, Gorman, & Co

except by breast-ropes. It is elastic and hermetically closed. A reservoir containing highly compressed air is fixed on the diver's back. This supplies him with air by a self-regulating apparatus at a pressure corresponding to his depth. When he wishes to ascend, he simply inflates his dress from the reservoir. Another form, known as the Fleuss dress, also makes the diver independent of exterior aid. The helmet contains a supply of compressed oxygen, and the exhaled breath is passed through a filter in the breast-piece which deprives it of its carbonic acid, while the nitrogen goes back into the helmet to be mixed with the oxygen, the supply of which is under the diver's own control, and to be breathed

over again. A diver has remained for an hour and a half under 85 feet of water in this dress. The safe limit for diving is 200 to 300 feet, the deepest dive in this country being 210 feet; but great care must be exercised in bringing the diver to the surface. Diving for pearls, sponges, valuables, &c., is now to a great extent carried on by means of diving-dresses.—BIBLIOGRAPHY: C. W. Domville-Fife, *Submarine Engineering of To-day*; G. W. M. Boycott, *Compressed Air Work and Diving*.

**Divining Rod**, a rod, usually of hazel, with two forked branches, used by persons who profess to discover minerals or water under ground. The rod, if carried slowly along by the forked ends, dips and points downwards, it is affirmed, when brought over the spot where the concealed mineral or water is to be found. Divination by means of rods is of great antiquity, and has been described by Cicero and Tacitus; their rods, however, were short bits of stick, and the forked hazel twig does not seem to have come into use before the early sixteenth century. Dr. H. Mayo gave a collection of discoveries made by it in his work *On the Truth contained in Popular Superstitions* (1847-51). The use of the divining rod is still common in many parts.—Cf. P. L. L. de Vallemont, *La Physique Occulte: ou Traité de la baguette divinatoire*.

**Divisibility**, that general property of bodies by which their parts or component particles are capable of separation. The study of radioactivity has shown that larger atoms may be broken up into smaller ones, and the old conception of the atom as an absolutely indivisible unit is no longer entertained by physicists. (See *Matter*.) Numerous examples of the division of matter to a degree almost exceeding belief may be easily instanced. Thus glass test-plates for microscopes have been ruled so fine as to have 225,000 spaces to the inch. Cotton yarn has been spun so fine that one pound of it extended upwards of 1000 miles, and a Manchester spinner is said to have attained such a marvellous fineness that one pound would extend 4770 miles. One grain of gold has been beaten out to a surface of 52 sq. inches, and leaves have been made 367,500 of which would go to the inch of thickness. Iron has been reduced to wonderfully thin sheets. Fine tissue paper is about the 1200th part of an inch in thickness, but sheets of iron have been rolled much thinner than this, and as fine as the 4800th part of an inch in thickness. Wires of platinum have been drawn out so fine as to be only the 30,000th part of an inch in diameter. Human hair varies in thickness from the 250th to the 600th part of an inch. The fibre of the coarsest wool is about the 500th part of an inch in diameter, and that of the finest only the 1500th

part. The silk line, as spun by the worm, is about the 5000th part of an inch thick; but a spider's line is only the 80,000th part of an inch in diameter; insomuch that a single pound of this attenuated substance might be sufficient to encompass our globe. The trituration and levigation of powders, and the perennial abrasion and waste of the surface of solid bodies, occasion a disintegration of particles almost exceeding the powers of computation. The solutions of certain saline bodies, and of other coloured substances, also exhibit a prodigious subdivision of matter. A single grain of sulphate of copper, or blue vitriol, will communicate a fine azure tint to five gallons of water. In this case the sulphate must be attenuated at least 10,000,000 times. Odours are capable of a much wider diffusion. A single grain of musk has been known to perfume a large room for the space of twenty years. At the lowest computation the musk had been subdivided into 320 quadrillions of particles, each of them capable of affecting the olfactory organs.

Division, in arithmetic, the dividing of a number or quantity into any parts assigned; one of the four fundamental rules, the object of which is to find how often one number is contained in another. The number to be divided is the *dividend*, the number which divides is the *divisor*, and the result of the division is the *quotient*. Division is the converse of multiplication.

Division, in the army, the smallest formation of troops which is a mixed force. A division, besides three brigades of infantry, includes artillery, engineers, and administrative troops. It is commanded by a major-general, and if at full strength consists of about 20,000 men.

Division, in Parliament, the mode of determining a question at the end of a debate. In the House of Commons the Speaker puts the question, and declares whether in his opinion the 'Ayes' or the 'Noes' have it. Should his opinion not be acquiesced in by the minority, the House is cleared, and the 'Ayes' directed to go into the right lobby and the 'Noes' into the left, where they are counted by two tellers appointed for each party. In the House of Lords the two sides in a division are called 'Contents' and 'Not-contents'.

Division of Labour, a method employed in productive undertakings for the simplifying of the work to be done by each of the workmen engaged therein. The separation of the process of production into a series of simple operations means that less ability on the part of the workman is required in order that he may acquire the necessary skill in performing any particular operation, and saves much time, partly because practice leads to each operation being more quickly performed, and partly by avoiding the

waste which takes place in workmen moving from one operation to another. Owing to both of these causes, the cost of producing complicated articles may be immensely reduced. By standardizing operations division of labour tends to the invention of machinery; increases the skill and dexterity of the individual workman in the particular operation in which he is engaged; enables semi-skilled or unskilled labour to replace skilled; makes a more continuous and economical use of capital possible; and conduces to the more economical distribution of labour by classing work-people according to their capacity. It has, however, a deteriorating effect on the labourer's usefulness as an all-round workman, and is liable to kill his interest in his work, thereby reducing the incentive to industry. What is called division of labour in English economics has been sometimes termed *co-operation* by foreign economists.

Divorce (Lat. *divortium*, from *divertere*, to turn apart, separate), a separation, by law, of husband and wife, which is either a divorce *a vinculo matrimonii*, that is, a complete dissolution of the marriage bonds, or a divorce *a mensa et thoro* (from bed and board), whereby the parties are legally separated, but not unmarried. The causes admitted by different codes of laws as grounds for the modification or entire dissolution of the marriage contract, as well as the description of tribunal which has jurisdiction of the proceedings, and the form of the proceedings, are various. Divorce was permitted by the law of Moses, but forbidden in the New Testament, except for adultery. The early laws of Rome permitted the husband to divorce his wife for adultery and many other alleged offences. The facility of divorce continued, without restriction, under the Roman emperors, but as the modern nations of Europe emerged from the ruins of the Roman Empire, they adopted the doctrine of the New Testament. Marriage, under the Roman Church, instead of a civil contract, came to be considered a sacrament of the Church, which it was unlawful to dissolve. The ecclesiastical courts could indeed annul a marriage, but only for a cause that existed at the time the marriage was contracted, such as prior contracts or impotency. For any cause arising after marriage they could only pronounce a divorce *a mensa et thoro*, which did not leave either party free to marry again, except by Papal dispensation. A divorce *a vinculo matrimonii*, for any cause arising subsequent to marriage, could formerly be obtained in England only by an Act of Parliament, and the ecclesiastical courts must have previously pronounced a divorce *a mensa et thoro*. The Act passed in 1857, however, established a new court for trying divorce causes, called the Court for Divorce and Matrimonial

Causes, since absorbed into the Probate, Divorce, and Admiralty Division of the High Court of Justice. According to present practice the husband may obtain a divorce for simple adultery; but if the wife is the petitioner, she must show that her husband has been guilty of certain kinds of adultery, or of adultery coupled with desertion or gross cruelty. Either party may marry again after divorce. A divorce cannot be obtained if it appear that the petitioner has been guilty of the same offence, or has been accessory to or has connived at the offence, or if there has been collusion between the parties to obtain a divorce, or if they have condoned the offence by living together as man and wife after discovery. The husband may claim damages from the adulterer, and the court may also order the adulterer to pay the costs of the proceedings, in whole or in part. The Act also abolished divorces *a mensâ et thoro*, substituting, however, judicial separations. (See *Judicial Separation*.) A decree for a divorce is always in the first instance a *decree nisi* (q.v.). A Matrimonial Causes Bill, introduced in the House of Lords in 1920, proposes to abolish the legal disabilities of a wife in this matter, and to grant divorce to husband or wife on any of the following grounds: (a) adultery; (b) desertion for at least three years; (c) cruelty; (d) incurable insanity coupled with at least five years' confinement under the lunacy laws; (e) incurable habitual drunkenness coupled with three years' separation under a temporary separation order granted on the ground of habitual drunkenness; and (f) imprisonment under a commuted death sentence. In Scotland, from the time of the Reformation, divorce might be obtained by either party on the ground of adultery, marriage being held to be only a civil contract, and as such under the jurisdiction of the civil courts. Condonation, or connivance, or collusion is sufficient to prevent a divorce from being obtained on the ground of adultery, but not recrimination, that is, a counter charge of adultery. Wilful desertion for at least four years is also held a valid reason for divorce. The action is carried on before the Court of Session. In other countries, including British colonies, the law relating to divorce varies greatly. In the United States of America, marriage, though it may be celebrated before clergymen as well as civil magistrates, is considered to be a civil contract, and the laws as to divorce, and the facility or difficulty of obtaining it, differ greatly in the several states. In France divorce was legalized in 1884, with conditions, after having been prohibited for many years.—BIBLIOGRAPHY: Lehr, *Le mariage, le divorce et la séparation de corps dans les principaux peuples civilisés*; Stephen, *Commentaries on the Laws of England*; Bryce, *Marriage and Divorce*.

Dixmude, a town of Belgium, in Flanders. It was the scene of severe fighting during the European War. Captured by the Germans, it was retaken by the Belgians on 29th Sept., 1918. Pop. 4040 (1911); 450 (1919).

Dixon, William Hepworth, miscellaneous writer, born at Manchester, 1821, died in London, 1870. In 1849 he published a memoir of Howard the philanthropist, which was followed by the *Life of William Penn* (1851), and by a work on Admiral Blake (1852). In 1853, after having been a contributor, he became chief editor of *The Athenæum*, a post which he retained till 1860. During this period he published several very popular works, including the *Personal History of Lord Bacon*, *The Holy Land*, and *New America*, the last being followed by *Spiritual Wives*. After his retirement from *The Athenæum*, and in the last ten years of his life, he gave to the world about twenty-five volumes of history, travel, and fiction, among others, *Free Russia*; *Her Majesty's Tower*; *The Switzers*; *History of Two Queens*, *Catherine of Aragon and Anne Boleyn*; *Diana Lady Lyle*, and *Ruby Grey* (both novels); and his last work, *Royal Windsor*.

Dizful, a town of Persia, near the western boundary, on the River Dizful; a place of great trade and manufactures. Pop. about 25,000.

Djavid Bey, Husscin, a Turkish Jew, one of the leaders of the Committee of Union and Progress, and Minister of Finance from 1914 to 1918. His advice that Turkey should adhere to strict neutrality during the European War was, unfortunately for his country, not followed by his colleagues, who decided to join Germany.

Djermal Pasha, Turkish soldier and politician, and one of the leaders of the Committee of Union and Progress. Minister of Marine in 1914, he commanded the Turkish forces in Palestine from 1915 to 1917, and became notorious on account of his oppression of and cruelties against the inhabitants of Syria and Palestine, and by his hatred of Zionism. Accused in 1918 of various crimes, such as misappropriation of funds, and compelled to flee from Constantinople, he was condemned to death in his absence in 1919. He was nevertheless one of the Turkish delegates who signed the Peace Treaty on 11th May, 1920.

Djokdjakarta, a Dutch residency in the Island of Java, on the south coast, with a capital of the same name. Its forests abound in teak. Its natural fertility is great, and rice, coffee, and tobacco are extensively cultivated. It is ruled by a sultan who is dependent on the Dutch. Pop. 441,800. The town is large and regular, and contains the sultan's water-palace, and the seat of the Dutch Resident, which is a fort commanding both the palace and the town. Pop. 97,058.

Dnieper (né'pér; Russ. *Dnjepr*, *dnyepri*;

anciently *Borysthēnēs*, or *Danapris*), a great river of Russia which rises in the government of Smolensk, flows first south-west, then south-east, and again south-west to the Black Sea. It begins to be navigable a little above Smolensk, and has a total length, including windings, of 1230 miles. Among its tributaries are the Beresina, the Pripet, the Desna, and the Psiol. In its lower course there are important fisheries. The region watered by the river in its lower course is famous for its great fertility, and is known as the *black-soil*. Between Kiev and Alexandrovsk it forms a series of cataracts. Since 1838 there have been steamboats on the river, and the trade carried by it is considerable. Through the Beresina Canal the Dnieper communicates with the Baltic Sea.

*Dniester* (uēs'tēr; Russ. *Dnjestr*; ancient *Tyras*), a large river of Europe (Poland, Roumania, and Ukraine), which has its source in the Carpathian Mountains, in Austrian Galicia, enters Russia at Chotin, and empties itself into the Black Sea, after a course of about 750 miles. Its navigation is difficult on account of frequent shallows and rapids.

*Doab'* (that is, *Two Waters*), a name in Hindustan applied indiscriminately to any tract of country between two rivers, like the Greek *Mesopotamia*. The tract between the Ganges and the Jumna is usually called *the Doab*; other similar tracts have their distinctive names, the Punjab being divided into five districts of this kind.

*Dobell'*, Sydney, English poet and man of letters, born in 1824, died 22nd Aug., 1874. His first poem, *The Roman*, appeared in 1850, and was favourably received by the critics. Among his other works are: *Balder*, *Sonnets on the War*, and *England in Time of War*.

*Döbeln* (deu'beln), a town of Saxony, about 40 miles south-east of Leipzig, with a great trade in grain, and manufactures of cloth, yarn, leather, and lacquered wares. Pop. 17,920.

*Döbereiner's Lamp*, a contrivance for producing an instantaneous light, invented by Professor Döbereiner, of Jena, in 1824. The light is produced by throwing a jet of hydrogen or a mixture of oxygen and hydrogen gases upon recently prepared spongy platinum, when the metal instantly becomes red-hot, and then sets fire to the gas. The action depends upon the readiness with which spongy platinum absorbs both oxygen and hydrogen. The intimate contact of the two gases leads to chemical combination with evolution of heat. Coal-gas may be employed instead of hydrogen, and this has led to the application of the principle to self-lighting devices for igniting gas flames.

*Dobritsch*, or *Bazarjik*, a town in Roumania, was, till the end of the second Balkan War, the

chief town in Bulgarian Dobrudja. It is situated on a small tributary of the Danube, and is on the Cernavoda-Constanza railway. At one time it was famous for its panair or great annual fair, but it is now no longer an important centre. Pop. 10,000.

*Dobrudja*, or *Dobrud'scha*, The (anciently *Scythia Minor*), a territory forming part of the kingdom of Roumania, included between the Danube, which forms its boundary on the west and north, the Black Sea on the east, and Bulgaria (to which it belonged before 1878) on the south. Its area, formerly 6000 sq. miles, was increased by the Treaty of Bucharest of 10th Aug., 1913, and is now 8969 sq. miles. During the European War the Dobrudja was invaded in 1916 by an army of Germans, Bulgarians, and Turks, under General von Mackensen. In 1918 Roumania was compelled by the Treaty of Bucharest to cede the Dobrudja to Bulgaria, but it was restored to her in 1919. There are some fertile spots, but on the whole it is marshy and unhealthy. The population is of various nationalities, Roumanians, Bulgars, Greeks, Turks, and Jews. The inhabitants engage in tillage and stock-rearing. The principal towns are Kustendje and Tulcha. See *Roumania*. Pop. 381,306.

*Dobson*, Henry Austin, poet, born at Plymouth in 1840. He was educated at Beaumaris, Coventry, and Strasbourg; in 1856 obtained a clerkship under the Board of Trade, where he rose to be one of the officials known as principals. His earliest verses first appeared in book form under the title *Vignettes in Rhyme and Vers de Société* (1873). His other volumes of verse include: *Proverbs in Porcelain* (1877); *Old World Idylls* (1883); and *At the Sign of the Lyre* (1885), which *The Athenæum* pronounced to be "of its kind as nearly as possible perfect". Among his prose works may be mentioned his lives of *Hogarth*, *Fielding*, *Steele*, *Goldsmith*, *Horace Walpole*, *Richardson*, and *Fanny Burney*; *Thomas Bewick and his Pupils*; *Four Frenchwomen*, a study on Charlotte Corday, the *Princesse de Lamballe*, and *Mesdames Roland and de Genlis*; three series of *Eighteenth Century Vignettes*; *A Paladin of Philanthropy*; *Sidewalk Studies*; *Old Kensington Palace*; *At Prior Park*; *A Bookman's Budget*; and several editions of standard works. His collected poems were published in one volume in 1897. Many of Mr. Dobson's poems are written in various French forms, such as the *rondeau* and *ballade*, and all are marked by gracefulness and ease. He died in Sept., 1921.

*Doce'tæ* (from Gr. *dokein*, to seem or appear), the name given, in the earlier ages of the Church, to those who denied the reality of the human form of Christ, maintaining it to be merely a phantom or shadow. In the sense of regarding Christ's body as a heavenly and ethereal, instead

of a human one, docetism had its partisans even among the orthodox.

**Dock**, a name applied to different plants of the genus *Rumex*, belonging to the rhubarb family (*Polygonaceæ*). These are large herbaceous plants, with stout roots, alternate and often entire leaves, and bearing panicles of small greenish flowers. They are very troublesome



Curly or Yellow Dock (*Rumex crispus*)

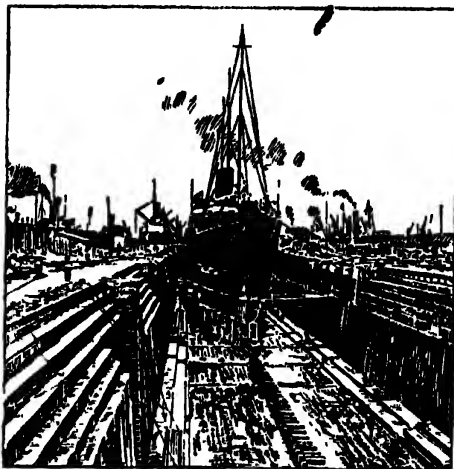
as weeds, but the roots of some of them are used medicinally as astringents.

**Docket**, or **Docquet** (dok'et; from *dock*, to shorten; Icel. *dokr*, stumpy tail), in law, a term variously used, as for a summary of a larger writing; a small piece of paper or parchment containing the heads of a writing; an alphabetical list of cases in a court, or a catalogue of the names of the parties who have suits depending in a court.

**Docks**, are artificial enclosures for the reception of shipping, for the purpose of loading, discharging, or repairs. They may be divided into four types, viz. tidal docks or basins, wet docks, dry or graving docks, and floating docks.

**Tidal Docks or Basins** are open permanently to the main channel or river, and the water-

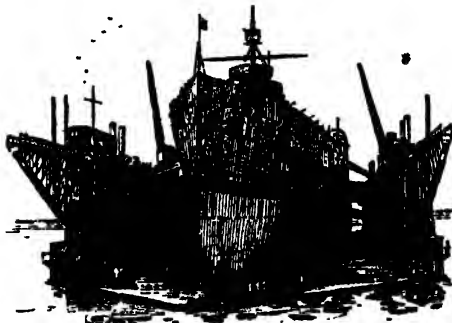
level therefore varies with the rise and fall of the tide. This variation of level is a serious hindrance in the work of loading or discharging cargo, unless the tidal range be small. It should



Dry Dock, Tilbury, Essex

be noted that this form is more properly termed a tidal basin.

**Wet Docks** have a water entrance normally closed by gates or caissons, which permit the water-level of the enclosed area being maintained at high-water level. This uniformity of



The Medway Floating Dock lifting H.M.S. *Lion*, 30,000 tons

level is of great service in dealing with cargo, but this type has the disadvantage of only permitting traffic in and out of the dock at high water. This disadvantage may be modified by the provision of a lock at the dock entrance.

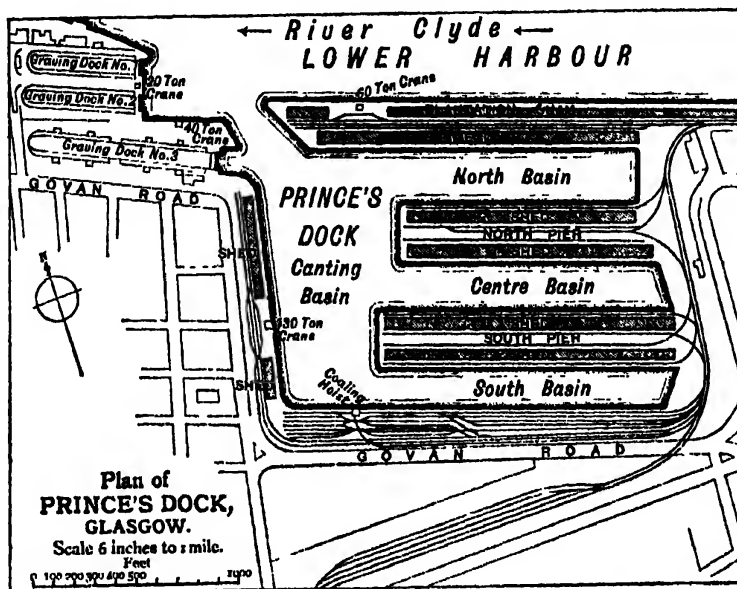
**Dry or Graving Docks** are used for the purpose of examining and repairing ships. The entrance is controlled by either gates or caissons. The ship having entered, the gates are closed, and the water pumped out, allowing the vessel to

settle down gradually upon a row of keel blocks, running up the centre line of the dock. The sides of the docks are built in the form of large continuous steps or 'altars', which support the ends of the timber shores which serve to keep the ship in an upright position. The floor is graded to channels, leading to powerful pumps, usually of the centrifugal type, and capable of emptying a large dock in one hour.

*Floating Docks* fulfil the same functions as dry docks. In their modern form, they consist of a hollow steel box or pontoon, carrying hollow

may be said to last indefinitely, subject only to the fact that it may outlive its usefulness.

The first wet docks constructed in England were those now called the Commercial Docks, in London, which existed in a much less extensive form so early as 1660. In 1800 the West India Docks were constructed, and were followed by the East India Docks, Millwall Docks, London Docks, the St. Katharine Docks, and the Victoria Docks, affording, together with those at Tilbury, more than 600 acres of water accommodation, besides wharf and warehouse grounds,



longitudinal walls at each side. These walls contain the pumps and controlling machinery, the pontoon portion being capable of being filled with or emptied of water, thus raising or sinking the dock. This lower portion is subdivided into a great number of compartments, all of which may be filled separately, so that errors of trim can be corrected. In making use of this type the dock is lowered by flooding the lower compartments. The ship is then floated into position and shored.

The initial cost of these two latter types is in favour of the floating dock, the annual maintenance charges of which, however, may be five to ten times those of an ordinary masonry dock. The mobility of a floating dock may be considered an advantage, allowing it to be easily removed to another locality to meet changing conditions, but this adaptability should not be overvalued.

The average life of a steel dock may be assumed to be 40 years, whereas a masonry dock

where all kinds of appliances and machinery for the speedy and convenient transfer of goods and cargoes are in use. Some of the warehouses are extremely capacious, the tobacco warehouse of the London Docks being itself nearly 5 acres in extent. Next after the London docks come those of Liverpool, which extend more than 6 miles along the north bank of the Mersey, and cover, together with the Birkenhead docks, nearly as large a total acreage as those of London. The other important British docks are those at Southampton, Bristol, Cardiff, Hull, Great Grimby, Newcastle, Shields, Barrow, Leith, Glasgow, Dundee, &c. A floating dock at Hamburg has a length of 728 feet, inside width of 123 feet, and a lifting capacity of 46,000 tons. —BIBLIOGRAPHY: W. Shields, *Principles and Practice of Harbour Construction*; L. V. Harcourt, *Harbours and Docks*; Kempe, *Engineer's Year Book*.

Dock-warrants, orders for goods kept in the

warehouses connected with a dock. They are granted by the proper officer at the dock to the importer in favour of any one that he may name. These warrants are held to be negotiable, so that they may pass from one holder to another, the property of them being always vested in the holder.

Dock-yards, establishments supplied with all sorts of naval stores, materials and conveniences for the construction, repairs, and equipment of ships of war. In England the royal dock-yards are at Chatham, Sheerness, Portsmouth, Devonport, and Pembroke, besides the Deptford and Woolwich store-yards. There are also royal dock-yards or naval victualling yards at Haulbowline in Cork Harbour, Rosyth, Invergordon, at the Cape of Good Hope, Gibraltar, Malta, Bermuda, Bombay, Calcutta, Hong-Kong, Sydney, and Wei-hai-wei. Others in the colonies have been given up. The dock-yards are under the direct control of the Admiralty. The chief officer of the greater or home dock-yards is generally an admiral, with a considerable staff of officials under him, professional and other. Since the introduction of steam the engineering department has become an important one in such establishments.

Doctor, a term literally signifying teacher. In the Middle Ages, from the twelfth century, it came into use as a title of honour for men of great learning, such as Thomas Aquinas (Doctor Angelicus) and Duns Scotus (Doctor Subtilis). It was first made an academical title by the University of Bologna, and emperors and Popes soon afterwards assumed the right of granting universities the power of conferring the degree in law. The University of Paris followed in the footsteps of Bologna, and in 1145 the title was bestowed on Peter Lombard. The faculties of theology and medicine were soon included, but for a long time the faculty of arts retained the older title of *Magister*, till the German universities substituted that of Doctor. In England the Doctor's degree was introduced into the universities during the reign of John or Henry III. The title of Doctor is in some cases an honorary degree, and in other cases (as in medicine and science) conferred after examination. The title of D.C.L. (Doctor of Civil Law), for example, at the Universities of Oxford and Durham, is frequently an honorary degree, and so also are those of D.D. (Doctor of Divinity) and LL.D. (Doctor of Laws) at various universities. The Popes and the Archbishops of Canterbury exercise the right of conferring the degree of Doctor both in law and divinity. Oxford and Cambridge, and many other universities, create doctors of music (Mus.D.).

Doctors' Commons was a college founded in 1567 for the Doctors of the Civil Law in

London, and was at one time the seat of the Court of Arches, the Archdeacon's Court, and the Court of Admiralty. The practitioners in these courts were called advocates and proctors. In 1857 an Act was passed empowering the college to sell its property and dissolve, and making the privileges of the proctors common to all solicitors.

Doctors of the Church, a name given to four of the Greek Fathers (Athanasius, Basil, Gregory Nazianzen, and Chrysostom) and five of the Latin Fathers (Hilary, Ambrose, Jerome, Augustine, and Gregory the Great). The Roman Catholic Church, however, recognizes eighteen 'Doctors of the Church', including, besides those already mentioned, Chrysologus, Leo, Isidore, Peter Damian, Anselm, Bernard of Clairvaux, Thomas Aquinas, Bonaventura, and Alphonsus of Liguori. The title is conferred only after death.

Doctrinaires, a section of French politicians, represented by the Duc de Broglie, Royer-Collard, Guizot, and others, who became prominent after the Restoration in 1815. They favoured a constitutional monarchy similar to that which then existed in Britain. In the Chambers they thus occupied a place between Radicals and ultra-Royalists. They received the name of *doctrinaires* because they were looked upon more as theoretical constitution-makers than practical politicians, and the term is now used with a wider application to political theorists generally.

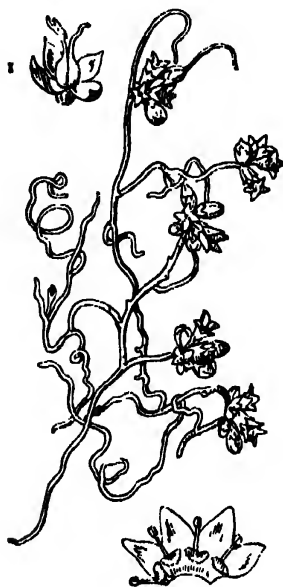
Dodder, the common name of the plants of the genus *Cuscuta*, a group of slender, branched, twining, leafless pink or white annual parasites, nat. ord. Convolvulaceae. The seeds germinate on the ground, but the young plant speedily attaches itself to some other plant, from which it derives all its nourishment. Four species are common in England—*C. europæa*, found on nettles and vetches; *C. Epithymum*, on furze, thyme, and heather (these two being natives); *C. trifolii*, on clover; *C. Epithymum*, on cultivated flax (both introduced from abroad).

Doddridge, Philip, D.D., an English Dissenting divine, born in London in 1702, died in 1751. He was an earnest pastor, and the author of many hymns and devotional treatises. *The Rise and Progress of Religion in the Soul* and *The Family Expositor* are amongst his best known works. Many of his hymns are still sung, such as *O God of Bethel, by whose hand;* and *O happy day that fled my choice.*

Dodecanese (Gr., twelve islands), a name applied since the Turko-Italian War of 1912-8 to a group of islands lying off the south-west coast of Asia Minor, the base of the Italian troops. The group, consisting of the Southern Sporades, includes the Islands of Patmos, Cos,



Lipsos, and others near Rhodes. Italy agreed to restore the islands to Turkey, but was prevented from carrying out the agreement by the breaking out of the Balkan War. By the Treaty of



Dodder

1. Pistil. 2. Corolla.

Lausanne (1923) Italian possession of those islands was confirmed, though Greece still maintains her claim.

**Dodgson**, Charles Lutwidge. See *Carroll*, *Lewis*.

**Dodo** (*Didus ineptus*), an extinct genus of birds once abundant on the Island of Mauritius, and assigned by naturalists to the ord. Columbæ or pigeons, though an extreme modification of the type. It was a massive clumsy bird, larger than a swan, covered with down instead of feathers, with short ill-shaped legs, a strong bulky hooked beak, and wings and tail so short as to be useless for flight. Its extinction was due to its organization not being adapted to the new conditions which colonization and cultivation introduced. It probably became extinct soon after 1681.

**Dodo'na**, a celebrated locality of ancient Greece, in Epirus, where was one of the most ancient Greek oracles. It was a seat of Zeus (surnamed the Pelasgian), whose communications were announced to the priestesses in the rustling of the leaves on its oak tree, and the murmuring of water which gushed forth from the earth.

**Dods**, Mārcus, theologian, born at Belford, Northumberland, in 1834, his father being mini-

ster of the Scottish Church there, died in 1909. He was educated in Edinburgh, where he took his M.A. degree at the age of twenty. In 1858 he was licensed as a minister of the Free Church of Scotland, and eight years afterwards was ordained to Renfield Free Church, Glasgow, where he remained until his appointment in 1889 to the chair of New Testament Exegesis in New College, Edinburgh. Of his works some of the most important are: *The Prayer that Teaches to Pray* (1863, 6th edition, 1889); *Epistles to the Seven Churches* (1805); *Israel's Iron Age* (1874); *Mohammed, Buddha, and Christ* (1877); *The Book of Genesis* (1882); *Parables of Our Lord* (1883 and 1885); *How to become like Christ* (1897); *Forerunners of Dante* (1903); *The Bible: its Origin and Nature* (1905); and articles in the *Encyclopædia Britannica*.

**Dodsley**, Robert, English poet, dramatist, and publisher, born in 1703, died in 1764. His first volume of verses, *The Muse in Livery*, appeared in 1732. *The Toy Shop* was performed at Covent Garden in 1735. In 1737 his *King and the Miller of Mansfield* was performed at Drury Lane, and met with an enthusiastic reception. He also wrote a tragedy, entitled *Cleone*, which had an extraordinary success on the stage. A selection of *Fables in Prose*, with an *Essay on Fables* prefixed, was one of his latest productions. He planned the *Annual Register* (commenced in 1758); the *Collection of Old Plays* (12 vols. 12mo), which now chiefly sustains his name as a publisher; and the *Collection of Poems by Different Hands* (6 vols. 12mo).

**Doe**, John, and Richard Roe, two fictitious personages of the English law who formerly appeared in a suit of ejectment. This fictitious form of procedure was abolished in 1852.

**Dog** (*Canis familiaris*), a digitigrade, carnivorous animal, forming the type of the genus *Canis*,



Dodo, from painting in the Belvedere, Vienna

which includes also the wolf, the jackal, and the fox. The origin of the dog is a much-debated question. The original stock is unknown, but various species of wolf and jackal have been suggested as ancestors. Probably a number of wild types were domesticated by prehistoric man, and there has been a good deal of crossing



between these different stocks. It is generally agreed that no trace of the dog is to be found in a primitive state, the dhole of India and dingo of Australia being believed to be wild descendants from domesticated ancestors. Several attempts to make a systematic classification of the varieties of dogs have been made, but without much success, it being difficult in many cases to determine what are to be regarded as types, and what as merely mongrels and cross-breeds. Colonel Hamilton Smith divides dogs into six



Jaws of Dog

m, Molars. pm, Premolars. cl, Caninial.  
can, Canines. i, Incisors.

groups as follows: (1) *Wolf-dogs*, including the Newfoundland, Esquimaux, St. Bernard, shepherd's dog, &c.; (2) *Watch-dogs and Cattle-dogs*, including the German boar-hound, the Danish dog, the mastiff dog, &c.; (3) *Greyhounds*, the lurcher, Irish hound, &c.; (4) *Hounds*, the blood-hound, staghound, foxhound, setter, pointer, spaniel, cocker, poodle, &c.; (5) *Terriers* and their allies; (6) *Mastiffs*, including the different kinds of mastiffs, bull-dog, pug-dog, &c. (See the different articles.) On each side of the upper jaw are three incisors, one canine, four premolars, and three or two molars; on each side of the lower jaw the same number, except that the molars are four or three. The fore-feet have five toes, the hind-feet four or five; the claws are strong, blunt, and formed for digging, and are not retractile. The tail is generally long, and is curled upwards. The female has six to ten mammae; she goes with young nine weeks as a rule. The young are born blind, their eyes opening in ten to twelve days; their growth ceases at two years of age. The dog commonly lives about ten or twelve years, at the most twenty. By English law it is prohibited to use dogs for purposes of draught. —BIBLIOGRAPHY: W. Youatt, *Training and Management of the Dog*; R. B. Lee, *A History and Description of Modern Dogs*; F. T. Barton, *Our Dogs and All about Them*; J. S. Turner and V. Nicolas, *The Kennel Encyclopædia*.

**Dog-days**, the name applied by the ancients to a period of about forty days, the hottest season of the year, at the time of the heliacal rising of Sirius, the dog-star. The time of the rising is now, owing to the precession of the

equinoxes, different from what it was to the ancients (1st July); and the dog-days are now counted from 8th July to 11th Aug., that is, twenty days before and twenty days after the heliacal rising.

**Doge** (dōj; from Lat. *dux*, a leader, later a duke), formerly the title of the first magistrates in the Italian Republics of Venice and Genoa. The first doge of Venice elected for life was Paolo Anafesto, in 697; and in Genoa, Siruone Bocconera, in 1339. In 1487 the Doge of Venice obtained from the emperor a diploma creating him 'Duke of Treviso, Feltre, Belluno, Padua, Brescia, Bergamo, &c.'. In Venice the dignity was always held for life; in Genoa, in later times, only for two years. In both cities the office was abolished by the French in 1797. The title was re-established in 1802 for the Ligurian Republic, but was abolished in 1805.

**Dog-fish**, a name given to several species of small shark, common around the British Isles. The rough skin of one of the species (*Scyllium canicula*), the lesser spotted dog-fish, is used by joiners and other artificers in polishing various substances, particularly wood. This species is rarely 3 feet long. *S. catulus*, the greater spotted dog-fish, is in length from 3 to 5 feet. It is blackish-brown in colour, marked with numerous small dark spots. Both species are very voracious and destructive. Their flesh is hard, dry, and unpalatable. The common or piked dog-fish (*Acanthias vulgaris*) is common in British and



Egg Capsule of Lesser Spotted Dog-fish

N. American seas, and is sometimes used as food. It is fierce and voracious. *S. profundorum* has been brought up from 816 fathoms in the North Atlantic. The tiger or zebra-shark (*Stegostoma tigrinum*) is a handsome dog-fish native to the Indian Ocean. It is marked with dark stripes on a yellow ground, and may attain the length of 15 feet.

**Dogger**, a Dutch vessel equipped with two masts and somewhat resembling a ketch. It is used particularly in the North Sea for the cod and herring fisheries.

**Dogger Bank**, an extensive sand-bank, near the middle of the North Sea, between Denmark on the east and England on the west, celebrated for its cod-fishery. It commences about 36 miles east of Flamborough Head and extends E.N.E. to within 60 miles of Jutland, in some places attaining a breadth of about 60 miles, though it terminates merely in a point. Where

shallowest the water over it is 9 fathoms. In Oct., 1904, the Russian Baltic Squadron fired upon a British fishing-fleet on the Dogger, killing two men. The incident was settled by arbitration. During the European War a naval battle was fought off the Dogger Bank on 24th Jan., 1915, in which three powerful German cruisers were seriously injured by a British fleet under Admiral Beatty, but made their escape to Hellgoland.

**Doggett's Coat and Badge**, the prize for a rowing-match which is held annually on the 1st Aug., the course being on the Thames from London Bridge to Chelsea. The match is open to six young watermen whose apprenticeship ends the same year, and the prize is a waterman's red coat bearing a badge which represents the white horse of Hanover. It was instituted—in celebration of the accession of George I—by the actor Thomas Doggett, born in Dublin; but though first rowed in 1710, its winners have only been recorded since 1791. The match, like other events of the same kind, suspended during the War, was held again on 3rd and 4th Aug., 1920, for the years 1915 to 1920.

**Dog-gods.** The dog was the first domesticated animal, and at an early period was deified. In ancient Egypt the god Anubis, who guided souls to the Otherworld, was dog-headed, as Herodotus says, or jackal-headed. Yama, the Indian god of death, has a dog form, and in the *Mahābhārata*, as Dhārma, god of justice (one of his forms), leads the Pandava brothers to Paradise as a dog. Indra had a dog form, and the custom still prevails among Northern Indian hill tribes of pouring hot oil in a dog's ear to bring rain; The Big Dog (Indra) is supposed to hear the howl of the tortured dog. The dog of Hades figures in Greek, Scandinavian, Celtic, and other mythologies. Cuchullin slew the dog of Hades, and was called 'Hound (cu) of Culann'. The widespread belief that dogs howl when a sudden death is about to take place has a long history. Dog ancestors figure in American, Javan, and other myths. In Japanese temples are images of 'Amu-Inu' (Heavenly Dog). Red Indian myths refer to a Dog Creator and to the eclipse-causing dog. Eskimos thrash dogs during an eclipse.

**Dogma** (Gr. *dogma*, from *dokein*, to seem), an article of religious belief, one of the doctrines of the Christian faith. The history of dogmas, as a branch of theology, exhibits in a historical way the origin and the changes of the various Christian systems of belief, showing what opinions were received by the various sects in different ages of Christianity, the sources of the different creeds, by what arguments they were attacked and supported, what degrees of importance were attached to them in different

ages, the circumstances by which they were affected, and the mode in which the dogmas were combined into systems. Lectures on this subject are common in the German universities. In English dogma and dogmatism have come to be frequently used for assertion without proof.

**Dogmat'ics**, a systematic arrangement of the articles of Christian faith (dogmas), or the branch of theology that deals with them. The first attempt to furnish a complete and coherent system of Christian dogmas was made by Origen in the third century.

**Dōgra.** The Dōgras are a race of Indian hillmen, descended from Rajputs, who in almost prehistoric times overran the country to the east of Jammu, in Southern Kashmir, and founded principalities. They are now found in and recruited from the country comprised within a rough triangle having Jammu, Simla, and Chamba at its angles; or more generally still, between the upper waters of the Rivers Chenab and Sutlej, two of the five rivers from which the Punjab takes its name. By religion the Dōgras are, as becomes their descent, strict Hindus; indeed, their religion may be considered Hinduism in its purer and more original form, uncontaminated by outside influences. As is the case with other high-caste Hindus, the Dōgra's life is largely governed by ceremonial observances, those relating to birth, initiation, marriage, and death being the more important. He is, however, rather less fastidious about ceremonial cooking than either the sacerdotal Brahman or his distant Rajput cousin of the plains.

The Dōgra is not a big man, his average height being barely 5 feet 5 inches, but he is sturdy, and develops well with training, and, being fond of sport and games, makes an excellent soldier, especially in his native hills. Being Rajputs by descent, they are essentially a race of soldiers, and, enlisted in the Indian army, give excellent service as such, being law-abiding, hardy and enduring, and quietly courageous. It has already been said that Dōgras are not so ceremonious in their cooking arrangements as either Brahmans or down-country Rajputs, who require separate cooking-places for each man; the Dōgra, on the other hand, though remaining very particular about his drinking-water utensils, will yet agree to have his food prepared for him in messes of five to ten men; this trait makes his value on service and under service conditions considerably greater than that of either of the two above-mentioned classes. In the Indian army there are three first-line battalions of Dōgras: the 37th, 38th, and 41st. These are what are known as class regiments; that is, they consist entirely of the one class. In addition to the three regiments, Dōgras also enlist in the cavalry and in class-

company regiments, i.e. regiments enlisting a variety of classes while keeping them separate inside the regiment.

**Dog-rose**, the *Rosa canina*, or wild brier, nat. ord. Rosaceæ. It is a common British plant, growing in thickets and hedges. The fruit is known as the hip.

**Dog's-mercury**, *Mercurialis perennis*, nat.



Dog's Mercury (*Mercurialis perennis*)

1, Male flower. 3, Same, enlarged. 2, Female flower.

ord. Euphorbiaceæ, a woodland herb common in Britain. It has poisonous properties, and may be made to yield a fugitive blue dye.

**Dog's-tail Grass** (*Cynosurus*), a genus of grasses. *Cynosurus cristatus* is a perennial found wild all over Great Britain in pastures, lawns, and parks. Its roots are long and wiry, and, descending deep into the ground, ensure the herbage against suffering from drought. Its stem is from 1 to 2 feet high, and its leaves are slightly hairy.

**Dog's-tooth Ornament**, an architectural ornament or moulding consisting usually of four leaves radiating from a raised point at the centre. It is the characteristic decorated moulding of Early English architecture, as the zigzag is of the Norman.

**Dog-tooth Spar**, a form of mineral calcium carbonate or calc-spar found in Derbyshire and other parts of England, and named from a supposed resemblance of its pointed crystals to a dog's tooth.

**Dog-watch**, a nautical term distinguishing two watches of two hours each (4 to 6 p.m. and 6 to 8 p.m.). All the other watches count four hours each, and without the introduction of the dog-watches the same hours would always fall to be kept as watch by the same portion of the crew.

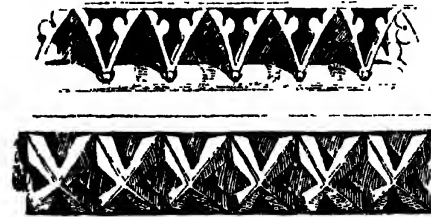
**Dogwood**, a common name of trees of the genus *Cornus*, but specifically applied in Britain to *C. sanguinea*. It is a common shrub in copses and hedges in England; the small cream-white flowers are borne in dense roundish clusters. The branchlets and leaves become red in autumn. The wood is used for skewers and for charcoal for gunpowder.

**Dolt**, an ancient Scottish coin, of which eight or twelve were equal to a penny sterling. In the Netherlands and Lower Germany there was a coin of similar name and value.

**Dol**, a town of France, department of Ille-et-Vilaine, 14 miles south-east by east of St. Mulo. The old cathedral of St. Samson mostly dates back to the thirteenth century. To the north of the town stretches a salt-marsh, protected from inroads of the sea by a twelfth-century dyke, and in the centre of the marsh Mont-Dol rises to a height of 213 feet. Pop. 3540.

**Dolci** (dol'chē), Carlo, celebrated painter of the Florentine school, was born at Florence in 1610, and died there in 1686. His works, principally heads of madonnas and saints, have a character of sweetness and melancholy. Among his chief productions are: *Archduchess Claudia*, in the Uffizi (Florence); *St. Cecilia at the Organ* and *Herodias with the Head of John the Baptist*, both in the Dresden Gallery; *Ecce Homo* and *St. Andrew in Prayer*, at the Pitti Gallery; and *Magdalene*, at Munich.

**Dolcinites**, a Christian sect of Piedmont, so named from their leader Doleino. They arose in



Dog's-tooth Ornaments. Early English Style

1804 as a protest against Papacy, but were suppressed by the troops of the Inquisition in 1807.

**Dol'drums**, among seamen, the parts of the ocean near the equator that abound in calms, squalls, and light baffling winds. The Horse Latitudes (see *Wind*) is a similar region.

**Dôle**, a town in France, Jura, 26 miles south-east of Dijon. It is of Roman origin, was long the capital of Franche Comté, and has some interesting antiquities. The manufactures are Prussian blue, hosiery, ironware, and leather. Pop. 16,204.

**Dol'erite**, compact rock of the Basaltic series, but crystalline throughout, composed of augite and labradorite with some titaniferous iron ore and often olivine. It makes, when unaltered, an excellent road-metal.

**Dolgel'ly**, a town of Wales, capital of Merionethshire, near the foot of Cader Idris. It was there that Owen Glendower held his Parliament in 1404 and signed his treaty with Charles VI of France. It has manufactories of woollens, flannels, and cloths. Pop. 2160.

**Dolicocephalic** (dol-i-ko-se-fal'ik), long-headed: a term used in anthropology to denote those skulls in which the diameter from side to side is less in proportion to the longitudinal diameter (i.e. from front to back) than 8 to 10.

**Dol'ichos** (-kos), a genus of leguminous plants, sub-ord. Papilionaceæ. They are found in the tropical and temperate regions of Asia, Africa, and America, and all produce edible legumes. *D. Lablab* is one of the most common kidney beans in India, and *D. biflorus* (horse-grain) is used as cattle-food in the same country. *D. Pachyrhizus tuberosus* of Martinique has a fleshy tuberous root which is an article of food.

**Dol'ichosaurus** ('long lizard'), an extinct snake-like reptile found in the English chalk, whose remains indicate a creature of aquatic habits from 2 to 3 feet in length.

**Dollar**, a silver or gold coin of the United States, of the value of 100 cents, or rather above 4s. sterling. The same name is also given to coins of the same general weight and value, though differing somewhat in different countries, current in Mexico, a great part of South America, Singapore, and the Philippine Islands. The name is from the Dutch (also Danish and Swedish:) *daler*, from Ger. *thaler*, so named from Ger. *thal*, a dale, because first coined in Joachimsthal, in Bohemia, in 1518. By the Act of 14th March, 1900, the gold dollar was declared to be the standard of value in the United States, but no provision was made for the issue of a coin corresponding to the unit.

**Dollar**, a town and police burgh, Scotland, Clackmannanshire, 10 miles E. by N. of Stirling, noted for its academy, founded by John Macnab, who left £90,000 for this purpose. The building, a handsome structure in the Grecian style, was erected in 1819. The population of the village is 1497.

**Dollart**, The, a gulf of the North Sea, at the mouth of the Ems, between the Dutch province of Groningen and Hanover. It was originally

dry land, and was formed by irruptions of the sea which took place in 1277 and 1580, overwhelming thirty-four large villages and numerous hamlets.

**Döllinger** (deul'ing-er), Johann Joseph Ignaz, a celebrated German theologian and leader of the Old Catholic party, was born at Bamberg, in Bavaria, in 1790, died in 1890. In 1822 he entered the Church, and soon after published *The Doctrine of the Eucharist during the First Three Centuries*, a work which won him the position of lecturer on Church history at the University of Munich. In later years he took an active part in the political struggles of the time as representative of the university in the Bavarian Parliament, and as delegate at the Diet of Frankfurt voted for the total separation of Church and State. In 1861 he delivered a course of lectures, in which he attacked the temporal power of the Papacy. But it was first at the Œcumenical Council of 1869-70 that Dr. Dollinger became famous over Europe by his opposition to the doctrine of Papal infallibility. In consequence of his opposition to the Vatican decrees, he was excommunicated in 1871 by the Archbishop of Munich. A few months later he was elected rector of the University of Munich, where he remained until his death. When the sentence of his excommunication was pronounced, he received honorary degrees from the Universities of Oxford and Edinburgh. Among his numerous works are: *Origins of Christianity*, *A Sketch of Luther*, *The Papacy*, *Lectures on the Reunion of the Churches*, and *Papal Legends of the Middle Ages*.

**Doll'ond**, John, an English optician of French descent, born in 1706, died in 1761. He devoted his attention to the improvement of refracting telescopes, and succeeded in constructing object-glasses in which the refrangibility of the rays of light was corrected.

**Dolls**, representing more or less realistically the human form, have, for more than fifty centuries, been the common playthings of children, more especially of girls, whose maternal instinct impels them to lavish upon these often crude surrogates all the affection and devotion which their elders display towards real babies. But in ancient times, and even in the ritual of many modern religions, worship is not infrequently paid to human images, which in ancient times, and among the less cultured modern peoples, are hardly distinguishable from dolls, such as children regard as playthings and their fancy endows with a crude animism. In the earliest times in which members of our own species, *Homo sapiens*, are known to have lived in Europe, i.e. at the latter part of the so-called Old Stone (paleolithic) Age, it was the custom to make grotesque representations of the female

form as small figurines of clay or stone, which were regarded as amulets identified with the Great Mother, the giver of birth or life to mankind. As 'givers of life' such amulets were believed to be able to protect their possessors against the risk of death, because they were regarded in the most literal sense of the term as life-giving. But it was not merely against the risk of death that such amulets were believed to be potent: they could add 'vital substance' to the living and the dead, rejuvenating and reinvigorating the former, and enhancing the chances of continued existence and survival to the latter. Enormous respect was naturally paid to figurines supposed to possess such far-reaching powers; and when the Great Mother came to be identified with various animals, such as the cow, pig, &c., the amulet was identified with these 'givers of life' and sometimes represented in their shape. This is intimately associated with the origin of *totemism* (q.v.). It is probable that the modern doll is in part at least the survivor of these primitive images of the deities of early peoples. The fact that modern dolls are usually of the female sex may also be due to the fact of the earliest prototype of the doll being an amulet representing the Great Mother.

**Dol'man**, a long robe worn by the Turks as an upper garment. It is open in front, and has narrow sleeves. It has given its name to a kind of loose jacket worn by ladies, and to the jacket worn by hussars.

**Dol'men**, a Celtic name meaning 'table-stone'. Although some apply the name to prehistoric stone chambers covered with more than one slab (really 'corridor tombs'), the Dolmen proper, whether round or square, has a single cover-slab, and three, four, or even more stones supporting it. Some authorities consider the name *dolmen* as simply a French equivalent for *cromlech* (q.v.).

**Dolomieu** (dol-o-myeu), Déodat Guy Silvain Tancrède Gratet de, a French geologist and mineralogist, born in 1750 at Dolomieu (Isère), died in 1801. After some years of military service, he devoted himself to geological researches. He accompanied the French expedition to Egypt, but was shipwrecked on his return off the coast of Taranto, and imprisoned and harshly treated by the Neapolitan Government. Among his works are: *Voyages aux Îles de Lipari* (1788), *Sur le Tremblement de Terre de la Calabre* (1784), *Philosophie minéralogique* (1802).

**Dol'omite**, a mineral, the main constituent of magnesian limestone. It is composed of carbonate of calcium and carbonate of magnesium in equal molecular quantities, and varies from grey or yellowish-white to yellowish-brown. Dolomite is easily scratched with the knife, and

is semi-transparent. It effervesces only slightly in cold hydrochloric acid. Its rhombohedral crystals are sometimes called *bitter-spar*. A variety is *pearl spar*, which has crystals with curvilinear faces and a pearly lustre.

**Dolomites**, a group of European mountains, a division of the Alps, in the Trentino, North Italy, and having the Piave and Rienz on the east, the Adige and Eisack on the west. They are named from the prevalence of the mineral dolomite, and present most interesting and picturesque scenery, the peaks being endlessly varied in form. The highest summits are Pail di San Martino (10,968 feet); Sorapiss (10,798 feet), and Monte Tofana (10,715 feet).

**Dolphin** (*Delphinus*), a cetaceous animal, forming the type of a family (Delphinidæ) which



Common Dolphin (*Delphinus delphis*)

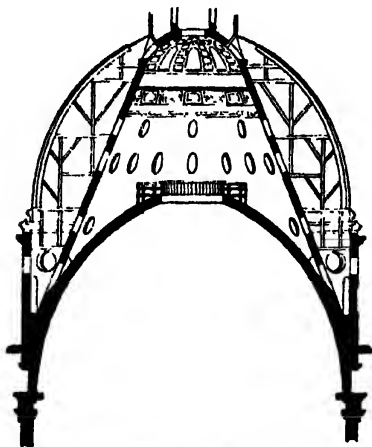
includes also the beluga or white whale (*Delphinapterus leucas*), the narwhal (*Monodon*), porpoises (*Phocaena*), the ca'ing whale (*Globicephalus melas*), and the killer whale or grampus (*Orca gladiator*). Dolphins inhabit every sea from the equator to the poles; they are gregarious, and swim with extraordinary velocity. The common dolphin (*D. delphis*) measures from 6 to 10 feet in length, has a long, sharp snout with numerous nearly conical teeth in both jaws; its flesh is coarse, rank, and disagreeable, but is used by the Laplanders as food. It lives on fish, molluscs, &c., and often may be seen in numbers round shoals of herring. The animal has to come to the surface at short intervals to breathe. The blow-hole is of a semilunar form, with a kind of valvular apparatus, and opens on the vertex, nearly over the eyes. The structure of the ear renders the sense of hearing very acute, and the animal is observed to be attracted by regular or harmonious sounds. A single young one is produced by the female, who suckles and watches it with great care, and anxiety, long after it has acquired considerable size. Dolphins are associated with many legends, and they figure in armorial bearings.—The name is also commonly but improperly given to fishes (species of *Coryphæna*) belonging to the mackerel family. They abound within the tropics, are about 4 or 5 feet long, very swift in swimming,

and are used as food, though said sometimes to be poisonous. The corn aphid (*Siphonophora granaria*) is locally known as the dolphin.

**Domain'**, same as *Demesne*; also applied especially to Crown lands or Government lands. — *Right of eminent domain*, the dominion of the sovereign power over all the property within the State, by which it is entitled to appropriate any part necessary to the public good, compensation being given.

**Dombrowski** (-brov'skē), Jan Henryk, a Polish general, distinguished in the wars of Napoleon, born in 1755, died in 1818. He supported the rising of the Poles under Kosciuszko in 1794. In 1796 he entered the service of France, and at the head of a Polish legion rendered signal services in Italy from 1796 to 1801. He took a distinguished part in the invasion of Russia in 1812, and also in the campaign of 1813. After Napoleon's abdication he returned to Poland, and the year following was made a Polish Senator by Alexander I.

**Dome**, a vaulted roof of spherical or other curvature, covering a building or part of it, and forming a common feature in Byzantine and also in Renaissance architecture. *Cupola* is also used as a synonym, or is applied to the interior, dome being applied to the exterior. (See *Cupola*.) Most modern domes are semi-elliptical in vertical section, and are constructed of timber; but the ancient domes were nearly hemispherical and constructed of stone. Of domes the finest,



Dome of St Paul's

Section showing the inner and outer domes with the conical wall. Diameter inside dome at base 102 feet.

without any comparison, ancient or modern, is that of the Rotunda or Pantheon at Rome (142½ feet internal diameter and 143 feet internal height), erected in the reign of Augustus, and still perfect. Among others the most note-

worthy are St. Sophia at Constantinople (104 × 201 feet), the cathedral of Santa Maria del Fiore at Florence (189 × 310 feet), St. Peter's at Rome (139 × 330 feet), St. Paul's, London (112 × 215 feet), the Hôtel des Invalides



The Pantheon, Rome

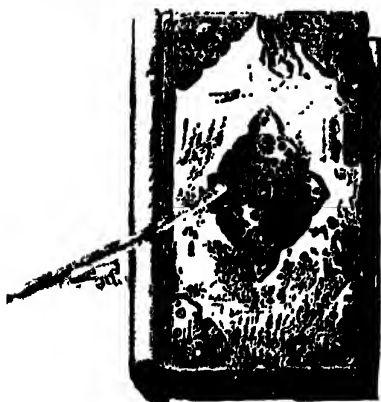
(80 × 173 feet) and the Pantheon (formerly the church of St. Geneviève) at Paris (87 × 100 feet). The figures represent the internal diameter and height in English feet. The largest dome in America is that of the Capitol at Washington, built of cast iron.

**Domenichino** (dō-men-i-kē'nō) (or Domenico) Zampieri, a distinguished Italian painter, of the Lombard school, born at Bologna on 21st Oct., 1581. He studied under Annibal Carracci, and afterwards went to Rome, where he became painter to Pope Gregory XV. Among his best works are the *Communion of St. Jerome* in the Vatican Museum, the *History of Apollo*, the *Martyrdom of St. Agnes*, and the *Triumph of David*. He died at Naples, 15th April, 1641.

**Domesday** (or *Doomsday*) Book, a book containing a survey of all the lands in England, compiled in the reign and by the order of William the Conqueror. The survey was made by commissioners, who collected the information in each district from a sworn jury consisting of sheriffs, lords of manors, presbyters, bailiffs, villeins—all the classes, in short, interested in the matter. The extent, tenure, value, and proprietorship of the land in each district, the state of culture, and in some cases the number of tenants, villeins, serfs, &c., were the matters chiefly recorded. The survey was completed within a year. Northumberland, Durham, Cumberland, and Westmoreland were not included in the survey, probably for the reason that William's authority was not then (1086) settled in those parts. The *Domesday Book* first appeared in print in 1783 in two folios. In 1816 two supplementary volumes were published. These contained four other records of the same nature. It has been

twice republished, the last time (1861-5) in perfect facsimiles of the original. — **BIBLIOGRAPHY:** *The Victoria County History*; F. W. Maitland, *Domesday Book and Beyond*; H. Ellis, *General Introduction to Domesday Book*; Birch, *Domesday: a Popular Account*.

**Domicile**, in law, the place where a person has a home or established residence. Domicile is often an important question in determining the efficacy of legal citations, the validity of marriage, the right of succession to property, &c. For some purposes what is called a temporary domicile is sufficient, but in questions of marriage and succession it is the permanent domicile that determines the decision. A permanent



Domesday Book

From the original in the Public Record Office, London.

domicile may be constituted by birth, by choice, or by operation of the law. To constitute a domicile by choice both actual residence and the intention to make it the permanent home are required. It is a legal principle that the wife takes the domicile of her husband. As a general rule the old domicile, and especially the domicile of origin, continues till a new one has been acquired.

**Dominant**, in music, the fifth tone of the diatonic scale. This tone assumes the character of a key-note itself when there is a modulation into the first sharp remove. Thus G is the dominant of the scale of C, and D the dominant of the scale of G.—*Dominant chord*, in music, that which is formed by grouping three tones, rising gradually by intervals of a third from the dominant or fifth tone of the scale. It occurs almost invariably immediately before the tonic chord which closes the perfect cadence.

**Dominic**, Saint, the founder of the order of the Dominicans, was born in 1170 at Calahorra, in Old Castile. He early distinguished himself by his zeal for the reform of canonical life and by

his success as a missionary amongst the Mohammedans. His attention having been directed to the Albigenses in the south of France, he organized a mission of preachers against heresy in Languedoc. In 1215 he went to Rome to obtain the sanction of Pope Innocent III to erect the mission into a new order of preaching friars. His request was only partially granted, and it was the succeeding Pope, Honorius III, who first recognized the importance of a preaching order, and conferred full privileges on the Dominicans. He also appointed Dominic Master of the Sacred Palace or court preacher to the Vatican, an office which is still held by one of the order. Dominic died at Bologna in 1221, and was canonized in 1234 by Pope Gregory IX. St. Dominic is usually considered the founder of the Inquisition, which is supposed to have originated with his mission to the Albigenses; but his claim is denied, on the ground that two Cistercian monks were appointed inquisitors in 1198.—*Cf. A. T. Drane, The Life of St. Dominic.*

**Dominica** (dom-i-nē'kă), a British West India island, so named because discovered by Columbus on a Sunday (Sp. *dominica*), constituting a presidency of the united colony of the Leeward Islands between Martinique on the south, and Guadeloupe on the north. It is about 20 miles in length, north to south, and 12 miles in breadth, east to west; area, 186,436 acres, about 65,000 being under cultivation. It is rugged and mountainous, but it contains many fertile valleys and is well watered. The shores are but little indented, and are entirely without harbours; but on the west side there are several good anchorages and bays. The principal exports consist of sugar, molasses, cocoa, and lime-juice. The imports and exports amount to about £160,000 and £120,000 annually. Dominica was ceded by France to Great Britain in 1763. Roseau is the capital. Pop. 33,803 (including about 420 aboriginal Caribs).

**Dominical Letter**, in chronology, properly called Sunday letter, one of the seven letters of the alphabet, A B C D E F G, used in almanacs, ephemerides, &c., to mark the first seven days of the year and all consecutive sets of seven days to the end of the year, so that the letter for Sunday will always be the same. If the number of days in the year were divisible by seven without remainder, then the year would constantly begin with the same day of the week; but as it is the year begins and ends on the same day, and therefore the next year will begin on the day following, and on leap years two days following, so that the same series is not repeated till after four times seven or twenty-eight years.

**Dominican Republic**, or **San Domingo**. See *Santo Domingo*.

**Dominicans**, called also *predicants*, or



*preaching friars (prædicatores)*, derived their name from their founder, St. Dominic. At their origin (1215, at Toulouse) they were governed by the rule of St. Augustine, perpetual silence, poverty, and fasting being enjoined upon them; and the principal object of their institution was to preach against heretics. Their distinctive



Dominican

dress consists of a white habit and scapular with a large black mantle, and hence they have been commonly known as *Black Friars*. They were almost from the first a mendicant order. They spread rapidly not only in Europe, but in Asia, Africa, and America. In England, where they founded their first house at Oxford, there were fifty-eight Dominican houses at the dissolution of the monasteries, and the Blackfriars locality in London took its name from one of their establishments. Four Popes, Innocent V, Benedict XI, Pius V, and Benedict XIII, were Dominicans, and the order produced some famous scholars, such as Albertus Magnus and Thomas Aquinas. As fierce opponents and strenuous combatants against any departure from the teaching of the Catholic Church, the Dominicans were entrusted with the conduct of the Inquisition, and became formidable as managers of this ecclesiastical institution, which was committed exclusively to them in Spain, Portugal, and Italy. In 1425 they obtained permission to receive donations, and ceased to belong to the mendicant orders, paying more attention to politics and theological science. With the Franciscans, their great rivals, they divided the honour of ruling in Church and

State till the sixteenth century, when the Jesuits gradually superseded them in the schools and courts. They obtained new importance in 1620 by being appointed to the censorship of books for the Church. Amongst notable Dominicans we may mention Savonarola, Las Casas, and Lacordaire, through whose efforts the order was revived in France in the nineteenth century. There are still establishments of the Dominicans both in England and Ireland, twenty-one houses for men and thirteen for women.—BIBLIOGRAPHY: Caro, *Saint Dominique et les Dominicains*; A. T. Drane, *The Life of St. Dominic, with a Sketch of the Dominican Order*.

Dom'ino, formerly a dress worn by priests in the winter, which, reaching no lower than the shoulders, served to protect the face and head from the weather. At present it is a masquerade dress worn by gentlemen and ladies, consisting of a long silk mantle with wide sleeves and a masquing hood. The name is also given to a half-mask formerly worn on the face by ladies when travelling or at masquerades.

Dom'inoes, a game played with small flat rectangular pieces of ivory, about twice as long



Dominoes

Left, Priest wearing domino over surplice, from brass plate at Bury St. Edmunds, 1514. Right, Lady wearing domino.

as they are broad. They are marked with spots varying in number. When one player leads by laying down a domino, the next must follow by placing alongside of it another which has the same number of spots on one of its sides. Thus if the first player lays down 6-4, the second may reply with 4-8, or 6-7, &c.; in the former case



he must turn in the 4, placing it beside the 4 of the first domino, so that the numbers remaining out will be 6-8; in the latter case he must turn in the 6 to the 6 in like manner, leaving 4-7, to which his opponent must now respond. The player who cannot follow suit loses his turn, and the object of the game is to get rid of all the dominoes in hand, or to hold fewer spots than your opponent when the game is exhausted by neither being able to play. The game was introduced into Europe about the middle of the eighteenth century.

**Domitian**, or in full Titus Flavius Domitianus Augustus, Roman emperor, son of Vespasian, and



Domitian

younger brother of Titus, was born A.D. 51, and in 81 succeeded to the throne. At first he ruled with a show of moderation and justice, but soon returned to the cruelty and excesses for which his youth had been notorious. He was as vain as he was cruel, and after an ineffective expedition against the Catti, carried a multitude of his slaves, dressed like Germans, in triumph to the city. He executed great numbers of the chief citizens, and assumed the titles of Lord and God. He established the most stringent laws against high treason, which enabled almost any-  
 ing to be construed into this crime. At length a conspiracy, in which his wife Domitia took part, was formed against him, and he was assassinated in his bedroom A.D. 96.

**Domrémy la Pucelle** (don-ré-mi là pû-sâl), the birth-place of Joan of Arc, a small French village, department of the Vosges, 7 miles N. of Neufchâteau. The house is still shown here in which the heroine was born, and in the neighbourhood is the monument erected to her memory.

**Don** (ancient Tanais), a river of Russia, which issues from Lake Ivan-Ozero, in the government of Tula; and flows S.E. through the governments of Riazan, Tambov, Voronej, and the Don Republic, to within 37 miles of the Volga, where a railway connects the rivers. It now turns abruptly S.W. for 236 miles, and falls into the Sea of Azov; whole course nearly 900 miles. The chief tributaries are: right bank, the Donetz

and Voronezh; left, the Khoper and Manych. Although not admitting vessels of much draught, the Don carries a large traffic, especially during the spring-floods, and a canal connects it with the Volga system of navigation. It has productive fisheries. The principal port is Rostov.

**Don**, a river, Scotland, Aberdeenshire, rising near the Banffshire border. It flows tortuously east through the whole breadth of Aberdeenshire, and falls into the North Sea a little to the north of Aberdeen, after a total course of 82 miles. Its salmon fisheries are of considerable value.—Also, a river of Yorkshire, England, which rises near Cheshire, and joins the Ouse after a course of about 70 miles. It is navigable for small craft as far as Sheffield.

**Don** (Lat. *dominus*, a lord or master), a Spanish title of honour, originally given only to the highest nobility, afterwards to all the nobles, and finally used indiscriminately as a title of courtesy. It corresponds with the Portuguese Dom. During the Spanish occupation it was introduced and became naturalized in some parts of Italy, and was particularly applied to the priests.

**Donaghadee** (don-ah-a-dé'), a seaport and market town, Ireland, County Down, on the Irish Channel, 16 miles east by north of Belfast. Pop. 4878.

**Donaldson**, Sir James, Scottish scholar, born in 1831 at Aberdeen, died in 1915. He was educated at Aberdeen University, and also at Manchester New College, London, and Berlin University. After being rector of Stirling High School, a classical master and rector of Edinburgh High School, he was appointed in 1881 to the Chair of Humanity (Latin) in Aberdeen University. In 1886 he became principal of the United College of St. Salvator and St. Leonard in St. Andrews University, and in 1890 principal of the university. He published a *Modern Greek Grammar for the use of Classical Students* (1853); *Lyra Græca: Specimens of Greek Lyric Poets, with Introduction and Notes* (1854); *History of Christian Literature and Doctrine from the Death of the Apostles to the Nicene Council* (1864-6); *The Ante-Nicene Christian Library* (24 vols., 1867-72, edited jointly with Professor A. Roberts); *The Apostolical Fathers* (1874); *Lectures on the History of Education in Prussia and England* (1874); *The Westminster Confession of Faith* (1905); *Woman: her Position and Influence in Ancient Greece and Rome, and among the Early Christians* (1907); *Addresses Delivered in the University of St. Andrews from 1886 to 1910* (1911). He was knighted in 1907.

**Donaldson**, John William, a distinguished English philologist, was born in London in 1811, died in 1861. He studied at London University, and at Trinity College, Cambridge, where

he was elected a fellow in 1835. His first work was *The Theatre of the Greeks*, a work showing much erudition. In 1839 he published *The New Cratylus*, which was amongst the earliest attempts to bring the philological literature of the Continent within the reach of the English student. In 1844 appeared the first edition of *Varronianus*, a work on Latin similar in scope to the *Cratylus*. Amongst his other writings are: *Christian Orthodoxy* (1855), *History of the Literature of Ancient Greece*, and grammars of the Hebrew, Greek, and Latin languages.

**Donatello** (properly, *Donato di Betto Bardi*), one of the revivers of the art of sculpture in Italy, was born at Florence between 1382 and 1387, died at Florence in 1466. His first great works in marble were statues of St. Peter and St. Mark, in the church of St. Michael in his native town, in an outside niche of which is also his famous statue of St. George. Along with his friend Brunelleschi he made a journey to Rome to study its art treasures. On his return he executed for his patrons, Cosmo and Lorenzo de' Medici, a marble monument to their father and mother, which is of high merit. Statues of St. John, St. George, Judith, David, John the Evangelist, and St. Cecilia are amongst his leading works.

**Donat'i's Comet**, so called from the Italian astronomer Donati, who first observed it on 2nd June, 1858. Next to the comet of 1811 it was the most brilliant that appeared last century. It was nearest the earth on the 10th Oct., 1858, and was seen until March, 1859. See *Comets*.

**Donatists**, one of a body of African schismatics of the fourth century, so named from their founder Donatus, Bishop of Case Nigræ, in Numidia, who taught that though Christ was of the same substance with the Father yet that he was less than the Father, that the Catholic Church was not infallible, but had erred in his time and become practically extinct, and that he was to be the restorer of it. All joining the sect required to be rebaptized, baptism by the impure Church being invalid.

**Donatus**, *Ælius*, a Roman grammarian and commentator, born A.D. 333. He was the preceptor of St. Jerome, wrote notes on Virgil and Terence, and a grammar of the Latin language so universally used in the Middle Ages that 'Donat' became a common term for grammar or primer of instruction.

**Donauwörth** (*don'ou-veurt*), a town, Bavaria, at the confluence of the Wörnitz and Danube. It was formerly a free Imperial town, and was stormed by the Swedes under Gustavus Adolphus in the Thirty Years' War, 1632. Pop. 5500.

**Don Beni'to**, a town, Spain, province of Badajoz. It has manufactures of woollens, and a trade in cattle, grain, and melons. Pop. 19,212.

**Don'caster** (*Danum* of the Romans, and *Dona Ceaster* of the Saxons), a municipal borough and market town, England, West Riding of Yorkshire, on the River Don, well built, with straight, broad streets. The parish church with its tower 170 feet high, Christ Church, the town hall, the theatre, are amongst the chief public buildings. It has railway workshops, manufactures of ropes, canvas, and machinery. It has been long celebrated for its annual races, begun in 1615, and held in September. Doncaster was originally a Roman station on the line of Watling Street. Pop. 80,520. It gives its name to a parliamentary division.

**Dondrah Head**, the southern extremity of the Island of Ceylon. It was the site of the Singhalese capital during part of the seventh century, numerous remains of which are still to be found.

**Don'egal** (*Dun-na-n Gal*, Fort of the Stranger), a maritime county, Ireland, province of Ulster, bounded north and west by the Atlantic Ocean; area, 1,197,154 acres, of which about a fifth is under crops. The coast is indented with numerous bays; the most remarkable being Lough Swilly. It is the most mountainous county in Ireland, but has some fine fertile valleys. Mount Errigal, the loftiest summit, is about 2400 feet high. The streams and lakes are small, but numerous and abounding in fish. The climate is moist, the subsoil chiefly granite, mica-slate, and limestone, and the principal crops oats, potatoes, and flax. Agriculture generally is in a very backward state. The manufactures are limited, and consist chiefly of linen cloth, woollen stockings, and worked muslin. The fisheries are extensive and valuable, and form the chief employment of the inhabitants of the coast and islands. Grain, butter, and eggs are exported. The minerals include marble, lead, and copper, are not wrought to advantage. Donegal four members to Parliament. Pop. 168.

**Donetz'**, a Russian river which rises in the government of Kursk, flows south and east, forming the boundary of several governments, and joins the Don; length, 400 miles. Its basin is rich in coal. See *Ukraine*.

**Don'gola**, a province of the Anglo-Egyptian Sudan extending on both sides of the Nile from about lat. 18° to lat. 20° N. After having belonged to Egypt, the rebellion under the Mahdi caused its evacuation by the Egyptian Government, leaving it in the hands of the dervishes, but the Anglo-Egyptian forces under Lord Kitchener again occupied it in 1896. Its chief products are dates, cotton, indigo, and maize. The population is a mixture of Arabs and indigenous Nubians. Its chief town is New Dongola, or El-Ordi, on the Nile. Pop. 20,000.

**Doni**, a clumsy kind of boat used on the eo

of Coromandel and Ceylon; sometimes decked, and occasionally furnished with an outrigger. The donis are about 70 feet long, 20 feet broad, and 12 feet deep, have one mast and a lug-sail, and are navigated in fine weather only.

**Donizetti**, Gaetano, Italian composer, born in 1797 at Bergamo, died 8th April, 1848. He studied music at Bologna under the distinguished Abbé Mattci. His first opera, *Enrico di Borgogna*, was represented at Venice in 1818. In 1822 his *Zoraida di Granata* gained him the honour of being crowned on the Capitol. In 1830 appeared his *Anna Bolena*, which first, along with *Lucrezia Borgia* and *Lucia di Lammermoor*—the latter his masterpiece—acquired for him a European fame. In 1835 Donizetti was appointed professor of counterpoint at the Royal College of Naples, but removed in 1840 to Paris, bringing with him three new operas, *Les Martyrs*, *La Favorita*, and *La Fille du Régiment*, of which the last two are amongst his most popular productions. Of his other operas none except *Linda di Chamounix* (1842) and *Don Pasquale* (1843) achieved any special triumph. He wrote in all as many as seventy operas.

**Donjon**, the principal tower of a castle, situated on the innermost court or bailey, which the garrison could make the last line of defence. Its lower part was commonly used as a prison.

**Don Juan** (Sp. pron. *hy-áur*), the hero of a Spanish legend which seems to have had some historical basis in the history of a member of the noble family of Tenorio at Seville. According to the legend, Don Juan was a libertine of the most reckless character. An attempt to seduce the daughter of the Governor of Seville brought the indignant father and the profligate don into deadly conflict, in which the former was slain. Don Juan afterwards, in a spirit of wild mockery, goes to the grave of the murdered man and invites the statue of him erected there to a revel. At the terror of Don Juan the 'stony guest' actually appears at the table to bear him away to the infernal world. The legend has furnished the subject for many dramas and operas. The most famous of the latter is Mozart's *Don Giovanni*, which has made the story familiar to everybody. Amongst the former are *Burlador de Sevilla* by Tellez, *Don Juan, ou Le Festin de Pierre* by Molière (1665), and *The Libertine* by Shadwell. The *Don Juan* of Byron bears no relation to the old story but in name and in the libertine character of the hero. Among the modern authors who have made use of the theme are: Prosper Mérimée, in *Les âmes du purgatoire*; A. Dumas, in *Don Juan de Marana*; Bernard Shaw, in *Man and Superman*; and José Zorrilla, in *Don Juan Tenorio*.—Cf. Gendarme de Bévotte, *La Légende de Don Juan*.

**Donkey-engine**, a small engine used in various

operations where no great power is required. Thus a donkey-engine is often stationed on the deck of a ship to work a crane for loading and unloading.

**Donnay**, Maurice Charles, French dramatist, born in Paris in 1850. His first work, *Phryné*, was produced in 1891, and was followed by an adaptation of Aristophanes' *Lysistrata*. His later works include: *Douloureuse* (1897), *Le Torrent* (1898), *L'Affranchie* (1898), *L'Autre Danger* (1901), *Le Retour de Jérusalem* (1908), *Le Ménage de Molière* (1912). He was elected to the Académie Française in 1907.

**Donne**, John, a celebrated poet and dean of St. Paul's, was the son of a merchant of London, in which city he was born in 1573. He studied both at Oxford and Cambridge. In his nineteenth year he abjured the Catholic religion, and became secretary to the Lord Chancellor Ellesmere, but finally lost his office by a clandestine marriage with his patron's niece, a daughter of Sir George More. The young couple were in consequence reduced to great distress, till his father-in-law relented so far as to give his daughter a moderate portion. In 1610 he wrote for the king the *Pseudo-Martyr*, and in 1612 he published a philosophical poem, *The Progress of the Soul*. By the desire of King James, Donne took orders, and, settling in London, was made preacher of Lincoln's Inn. In 1621 he was appointed Dean of St. Paul's. He was chosen prolocutor to the Convocation from 1623-4. He died in March, 1631, and was interred in St. Paul's. As a poet, Donne stands extremely high, and may be deemed the founder of what Dr. Johnson calls the *metaphysical* class of poets. Abounding in thought, this school generally neglected versification, and that of Dr. Donne was peculiarly harsh and unmusical. His style is quaint and pedantic; but he displays sound learning, deep thinking, and originality of manner. A collection of his poems appeared in 1633, and they include: *The Storm*, *The Calm*, *The Blossom*, and *Upon Parting with his Mistress*. He also wrote *Letters*, *Sermons*, *Essays on Divinity*, and other pieces.—Cf. E. Gosse, *Life and Letters of John Donne*.

**Donnybrook**, formerly a village, Ireland, now a suburb of Dublin. Its famous fair, instituted under King John in 1204, and which seldom passed off without riot and bloodshed, was abolished in 1855.

**Don Republic**, a republic in south-eastern Russia, formerly a government of imperial Russia, and known as the Don Cossacks' Territory. The republic was proclaimed in Jan., 1918; its capital is Novo-Tscherkassk.

**Doombook**, a code of laws compiled by King Alfred from the West-Saxon collection of his ancestor Ina, and comprising small portions of

the Mercian laws of Offa, and of the Kentish collection of Ethelbert. The code begins with the words: "The Lord spake these words to Moses, and thus said: I am the Lord thy God".—Cf. B. Thorpe, *Ancient Laws and Institutes of England*.

**Doon**, a river in Ayrshire, Scotland, which issues from the long, narrow Loch Doon, and falls into the Firth of Clyde; length, 27 miles.

**Doppler's Principle**, the principle by which the motions of heavenly bodies in the line of sight can be determined spectroscopically. When the distance between a body and the observer is being diminished, the number of waves of light of any definite colour received from it per second is increased, just as a swimmer meets more waves in the same time if he swims to meet them. Each colour of light is, therefore, slightly shifted towards the violet end of the spectrum. Thus any radiation or absorption lines seen are shifted towards the violet. If the body's distance is increasing, they are shifted towards the red. By investigation of such displacements, the motions of stars, nebulae, &c., in the line of sight can be measured, the dimensions of the orbits of double-stars gauged, the motions of gases in the solar atmosphere determined, and the rotational velocity of the sun's surface found for latitudes where sun-spots are rarely or never visible. The speed and direction of the sun's motion through space, viz. 12 miles per second towards a point in the constellation Hercules, has also been determined by this means.

**Dor**, or **Dorr**, the black-beetle, *Geotrupes stercorarius*, one of the most common British beetles, of a stout form, less than 1 inch long, black with metallic reflections, not to be confounded with the cockroach, commonly but erroneously called black-beetle. It may often be heard droning through the air towards the close of the summer twilight.

**Dora**, the name of two rivers in Northern Italy, both tributaries of the Po. The Dora Baltea rises on the southern slopes of the Mont Blanc group, and falls, after a course of about 100 miles, into the Po below Chivasso; the Dora Riparia, about 75 miles long, rises in the Cottian Alps, and joins the Po below Turin.

**Do'ran**, John, English writer, born 1807, died 1878. He began writing when a mere youth, and produced a great number of books, among them being *Lives of the Queens of England of the House of Hanover*, *Monarchs retired from Business*, *History of Court Fools*, *The Book of the Princes of Wales, Their Majesties' Servants* (a history of the English stage from Betterton to Kean), *Saints and Sinners*, *A Lady of the Last Century* (Mrs. Montague), *London in Jacobite Times*, and *Memories of Our Great Towns*. In

and about *Drury Lane* was published after his death. He was editor of *Notes and Queries* at the time of his death.

**Dorcas Society** (from *Dorcas* mentioned in *Acts*, ix, 36–42), an association generally composed of ladies for supplying clothes to the poor. Frequently the members of the society meet at stated times and work in common. Partial payment is generally required from all recipients except the very poor. Most of these societies are connected with churches of one denomination or another.

**Dorchester**, a municipal borough of England, chief town of Dorsetshire, 118 miles s.w. of London. There are large cavalry and infantry barracks a little to the west of the town. The trade consists chiefly in agricultural produce. Dorchester was an important Roman station (*Durnovaria*), and many interesting Roman remains, such as the 'Maumbury Rings' (a Roman amphitheatre), are still to be found in the vicinity. It was a parliamentary borough till 1886, when it was merged in the county. Pop. 9842.

**Dordogne** (dor-dony), a department of France, which includes the greater part of the ancient province of Périgord, and small portions of Limousin, Angoumois, and Saintonge. Area, 3544 sq. miles, of which about a third is fit for the plough. The chief minerals are iron, which is abundant, slate, limestone, marble, and other stone. Mining, iron manufacture, &c., are carried on to a considerable extent, and there are a number of vineyards. The climate is mild but somewhat changeable. Pop. 396,702.—The river *Dordogne*, principal river of the department, rises on the flanks of the Puy-de-Saney, flows w.s.w., and, after a course of 290 miles, unites with the Garonne in forming the Gironde.

**Dordrecht**. See *Dort*.

**Doré** (dō-rā), Gustave Paul, a prolific French draughtsman and painter, born at Strasbourg 6th Jan., 1833, died 23rd June, 1883. He studied at Paris, contributing, when only sixteen years of age, comic sketches to the *Journal pour Rire*. He distinguished himself greatly as an illustrator of books. His illustrations of Rabelais (*Rabelais Illustré*), of Perrault's *Tales*, Sue's *Wandering Jew*, Dante's *Divina Commedia*, and Cervantes' *Don Quixote* displayed great fertility of invention, and the fine fantasy of his landscapes and the dramatic effectiveness of his groups acquired for him a European reputation. His illustrations of the Bible, of Ariosto's *Orlando Furioso*, and Milton's *Paradise Lost* are also of high excellence. As a painter he has grandeur of conception and a bold expressive style. Amongst his chief works are: *Christ leaving the Praetorium*, *Paolo and Francesca di Rimini*, *The Flight into Egypt*, and *Mont Blanc*. In later years Doré also won fame as a sculptor.

**Dore'ma**, a genus of plants, nat. ord. Umbelliferae. *D. ammonitidum*, a Persian species, yields the ammoniacum of commerce, a milky juice that exudes from punctures on the stem and dries in little 'tears'.

**Doria**, one of the most powerful families of Genoa, became distinguished about the beginning of the twelfth century, and shared with three other leading families, the Fieschi, Grimaldi, and Spinola, the early government of the Republic. Amongst the older heroes of this family are Oberto Doria, who in 1284 commanded the Genoese fleet which at Meloria annihilated the power of Pisa; Lamba Doria, who in 1298 defeated the Venetian Dandolo at the naval battle of Curzola; Paganino Doria, who in the middle of the fourteenth century distinguished himself by great victories over the Venetians. But the greatest name of the Dorias is that of Andrea, born at Oneglia in 1466, of a younger branch of the family. After serving some time as a condottiere with the princes of Southern Italy, he was entrusted by the Genoese with the reconstruction of their fleet. Disagreement with the Genoese factions drove him to take service with Francis I of France, in which he highly distinguished himself, and in 1527 he took Genoa in the name of the French king. But being displeased with the projects of Francis for reducing Genoa to a place of secondary importance, he went over to the service of Charles V, carrying with him the whole influence and resources of Genoa, and hastened the deliverance of Italy from French domination. He entered Genoa in 1528, re-established order, reorganized the Government, and, although refusing the title of doge, practically controlled its affairs to the end of his life. The country bestowed on him the title of *Father of Peace*. As Imperial Admiral he performed many services for Charles, clearing the seas of Moorish pirates and assisting the emperor in his expeditions to Tunis and Algiers. In 1547 his authority was threatened by the conspiracy of Fieschi, and he narrowly escaped assassination in the tumult. He died in 1560.

**Dorians**, one of the three great branches of the Greek nation who migrated from Thessaly southwards, settling for a time in the mountainous district of Doris in Northern Greece and finally in Peloponnesus. Their migration to the latter was said to have taken place in 1104 B.C.; and as among their leaders were certain men reputed to be descendants of Hercules (or Herakles), it was known as the return of the Heraclidae. The Dorians ruled in Sparta with great renown as a strong and warlike people, though less cultivated than the other Greeks in arts and letters. Their laws were severe and rigid, as typified in the codes of the great Doric legislators Minos and Lycurgus.—The *Doric*

*dialect* was characterized by its broadness and hardness, yet on account of its venerable and antique style was often used in solemn odes and choruses.

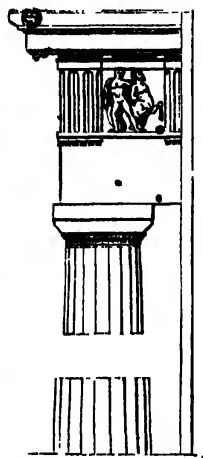
**Doric Order**, in architecture, is the oldest, strongest, and simplest of the three Grecian orders, and the one that is best represented among the remains of ancient Greek architecture. The Doric column is distinguished by its want of a base (in the more ancient examples, at least), by the small number of its flutings, and by its massive proportions, the true Grecian Doric having the height of its pillars six times that of the diameter. The capital was small and simple, and the architrave, frieze, and cornice were rather plain and massive.

**Dorigny** (do-rē-nyē), the name of several French painters and engravers. Michael, born in 1617, became professor in the Academy at Paris, and died in 1665. Louis, son of the preceding, was born in 1654, settled in Italy, and died in 1742. Sir Nicholas, brother of Louis, born in 1658 at Paris, was the most celebrated of the three. He spent eight years in engraving the famous cartoons of Raphael at Hampton Court, and was knighted by George I. He died in 1746.

**Doris**, anciently a small and mountainous region of Northern Greece, at one time the abode of the Dorians. It now forms an eparchy in the nomarchy of Phocis.

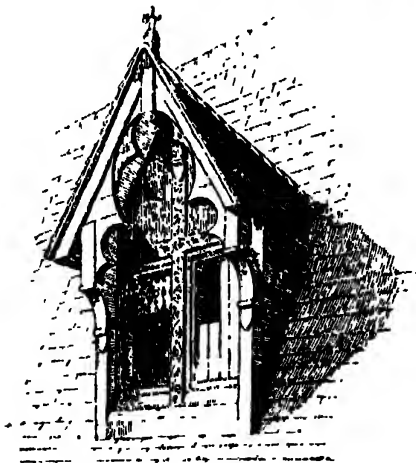
**Dorking**, a town of England, county of Surrey, 22 miles S.S.W. of London, largely consisting of villa residences. Large numbers of fowls, known as *Dorkings*, of an excellent breed, having five claws on the foot, are reared here, and sent to the London markets. The breed was introduced both into Gaul and Britain when those countries were subject to the Roman power. Pop. (urban district), 7850.

**Dormant State**, a state of torpidity in which certain animals pass a portion of the year. In cold and temperate climates this period of long sleep takes place during the winter months, and is properly called *hibernation*. It commences when the food of the animal begins to get scarce, continues for a longer or shorter period, and is deeper or lighter according to the habits and constitution of the animal. Bats, bears, some



Grecian Doric Order

animals of the rodent order, such as the porcupine, the dormouse, and the squirrel, all the animals belonging to the classes of Amphibia and Reptilia, such as tortoises, lizards, and snakes (frogs, &c.), also many species of molluscs and insects, hibernate more or less completely, retiring to suitable places of concealment—the bat to dark caves, the hedgehog to fern-brakes, and snakes to holes in trees. During hibernation there is a great decrease of heat in the bodies of the animals, the temperature sometimes sinking to 40° or even 20° F., or in general to a point a little above that of the surrounding atmosphere. The respiration as well as the pulsation of the heart is exceedingly slow, and the irritability of the animal often so low that in some cases it can be awakened only by strong electric shocks. With frogs and other amphibia the dormant state is very common, and if the temperature is kept low by artificial means, they may remain dormant for years. The term *æstivation* has been used to describe a similar condition into which certain animals, such as serpents and crocodiles, in tropical countries pass during the hottest months of the year. Plants also present many interesting examples of the dormant state, by which unfavourable periods or conditions are tided over. A seed, for instance, contains a dormant embryo or plantlet, which resumes growth (i.e. germinates) when the temperature rises above a certain level, provided sufficient moisture and air are present. Many lower forms,



Dormer Window. Abbeville, Fifteenth Century

notably bacteria, are able to form thick-walled cells (spores) that can retain their vitality for a considerable time.

**Dormer Windows** (Fr. *dormir*, to sleep), are windows inserted in the inclined plane of a

sloping roof, on a frame rising vertically above the rafters. They are named dormer windows because they are found chiefly in attic bedrooms.

**Dormouse**, the popular name of small rodent mammals constituting a special family (Gliridae



Dormouse (*Muscardinus avellanarius*)

or Myoxidae) allied to rats and mice. They inhabit temperate and warm countries, and subsist entirely on vegetable food. Their pace is a kind of leap, but they have not the activity of squirrels. Whilst feeding they sit upright and carry the food to their mouths with their paws. Dormice pass the winter in a lethargic or torpid state, reviving only for a short time on a warm sunny day, when they take a little of their hoarded stores and then relapse into the dormant state. The squirrel-tailed or 'fat' dormouse (*Myoxus glis*) of the continent was esteemed as an article of diet by the ancient Romans. The common British dormouse (*Muscardinus avellanarius*) is a graceful little creature about 3 inches in length, with a tail 2½ inches long. It feeds on hazel-nuts, eggs, and insects, and constructs a spherical nest. It is not known to occur in Scotland or Ireland.

**Dornbirn**, a manufacturing town in Tyrol, about 6 miles from the Lake of Constance. Pop. 28,550.

**Dornick**, a kind of stout figured linen fabric used for table-cloths, and generally chequered. It derives its name from Doornik, or Tournai, in the Netherlands. The manufacture was brought into Norfolk by the Dutch.

**Dornoch** (-noh), a seaport and royal burgh of Scotland, county of Sutherland, at the entrance of the Dornoch Firth, the seat of the extinct bishopric of Caithness. It was one of the Wick district of parliamentary burghs. Pop. 740. —The Firth runs inland for about 16 miles between Ross-shire and Sutherlandshire.

**Dor'ohoi**, a town of Roumania in N.W.

Moldavia, near the Austrian frontier. Pop. 11,140. — The department of *Dorohoi* has an area of 1090 sq. miles, and a pop. of 189,789.

Dor'pat (Tartu), a town, formerly in the Russian province of Livonia, now belonging to the Republic of Esthonia. It is situated on the Embach, about 135 miles N.E. of Riga. Dorpat is chiefly remarkable for its university and other educational establishments. It is an ancient town, and was once a member of the Hanseatic Union. Captured by the Russians in 1559, it was ceded to Poland in 1582, was subsequently taken by the Swedes, and in 1704 passed to the Russians, who called it *Yuryev*. The town was occupied by the Germans on 18th Feb., 1918. The vernacular language is Esthonian, but the upper classes speak German. Pop. 44,140.

D'Orsay, Alfred, Count, a dilettante artist and man of fashion, born at Paris 1801, died 1852. When a young man he visited England, and became acquainted with Byron and other literary and fashionable celebrities. He married a daughter of the Earl of Blessington, but after the earl's death a separation took place, and D'Orsay became an inmate of Gore House, which the Countess of Blessington had made the centre of a famous literary coterie. A zealous Bonapartist, he followed Prince Louis Napoleon to Paris in 1849, and enjoyed his favour till his death. Disraeli has described him in his novel *Henrietta Temple*, under the name of 'Count Mirabel'. — Cf. Richard Madden, *Life of Lady Blessington*.

Dorset, Earl of. See *Sackville*.

Dorset, or Dorsetshire, a maritime county in the south of England, haying on the south the English Channel; area, 627,265 acres, over 400,000 being under crop. The general surface of the county is undulating; its principal elevations being chalk hills known as the North and South Downs, upon which immense flocks of sheep are pastured. On the south, on the borders of Hampshire and along part of the sea-coast, is a heathy common. A great part of the county is in grass, and dairy husbandry is extensively carried on. Neither coal nor ores of any kind are found, but the quarries yield the well-known Portland stone. Pipe-clay, plastic clay, and potter's clay also abound. The principal manufactures are those of flax, canvas, duck, &c., also silk and woollens. The fish frequenting the coast are of various kinds, but mackerel is the most abundant. Near the mouth of Poole harbour is a prolific oyster bank. The principal rivers are the Stour, the Frome, and the Piddle. The county has four parliamentary divisions, with a member for each. Dorchester is the county town. Other towns are Bridport, Poole, and Weymouth. Pop. 228,274.

Dorsetshire Regiment, The, once known

as the East Middlesex, dates from 1702, and is intimately associated with Gibraltar, which it twice defended during siege (1727 and 1779-82). For its services in India under Clive it bears the motto *Primus in India*. It later took part in the relief of Ladysmith, and during the European War suffered heavily on the Western front, being also represented at Kut and Ramadie.

*Dorate'nia*, a genus of plants, nat. ord. Moraceæ, found in tropical America. They have their naked flowers buried in a flat, fleshy, somewhat concave receptacle. *D. Contrayerva* and other species have a stimulant and tonic rhizome, which is used medicinally under the name of *contrayerva*.

Dort, or Dordrecht, a town, Holland, province of South Holland, 14 miles S.E. of Rotterdam, on the Merwede, an arm or part of the Maas, and on an island separated from the mainland by an inundation in 1421. It is an old town, founded in 1018 by Count Dietrich III of Holland, with a fine Gothic Church (Grote Kerk, 'Great Church'), a good town-house and museum. It was formerly of more importance than now, but it still carries on an extensive trade, being not only near the sea, but by the Rhine, the Maas, and other water communications, connected with an immense extent of inland territory. Pop. 47,300.

Dort, Synod of, an assembly of Protestant divines convoked at Dort on 13th Nov., 1618, dissolved on 9th May, 1619. Besides the Dutch and Walloon divines, it included representatives from England, Scotland, Switzerland, and part of Germany, in all about sixty-two native and twenty-four foreign deputies. The Synod was convoked principally for the sake of crushing the Arminian party, and extreme measures were taken to prevent that party being represented in the assembly or having a free voice there. The result was the condemnation of the Arminians and the dogmatic establishment of Calvinism in the Reformed Church. The Synod also set on foot the Dutch translation of the Bible known as the Dort Bible.

Dort'mund, a city of Prussia, province of Westphalia, on the Emscher, 47 miles N.N.E. of Cologne, starting-point of an important canal to the lower Ems. It has rapidly increased in recent years, being the centre of important railway systems, having extensive coal-mines in the vicinity, and active manufactures of iron, steel, machinery, and railway plant. There are also a number of breweries, potteries, tobacco factories, and chemical works. It was once a free Imperial Hanseatic town, and the seat of the chief tribunal of the Vehm. Pop. 214,228.

Dory, or John Dory (*Zeus faber*), a bony fish which is the type of a special family (Zeidae).



and is celebrated for the delicacy of its flesh. It seldom exceeds 18 inches in length, and is yellowish-green in colour with a blackish spot on each side, which, according to an old superstition, is the mark of St. Peter's forefinger and thumb; another claimant for this honour is the haddock. The dory is found on the Atlantic shores of Europe and in the Mediterranean. The name John Dory is supposed to be derived from the Fr. *jaune dorée*, golden yellow.



Dory (*Zeus faber*)

**Dōsith'eans**, an ancient sect among the Samaritans, so called from their founder Dositheus, who was a contemporary and associate of Simon Magus, and lived in the first century of the Christian era. They rejected the authority of the prophets, believed in the divine inspiration of their founder, and had many superstitious practices.

**Dosso Dossi**, Giovanni di Lutero, Italian painter of the Ferrara school; born 1479, died 1542. He was much honoured by Duke Alfonso of Ferrara, and immortalized by Ariosto (whose portrait he executed in a masterly manner) in his *Orlando*. Modena, Ferrara, and Dresden possess most of his works. *Circe in the Woods* is in the Borghese Gallery, and *St. Sebastian* in the Brera at Milan.

**Dost Mohammed Khan**, born about 1790, a successful usurper who obtained possession of the throne of Afghanistan after the flight of Mahnud Shah in 1818. He ruled with very great ability, and although driven from his throne by a British army, was ultimately restored and became a steady supporter of British power in the East. He died in 1863.

**Dostolev'sky**, Feodor Mikhailovitch, a famous Russian novelist, born 1821, died 1881. After serving as an officer of engineers he devoted himself to literature, but becoming connected with the communistic schemes of Petrashevsky, he was condemned to death. At the last moment, when Dostoevsky was already on the scaffold, the sentence was commuted, and he was banished to the mines of Siberia. Pardonned by Alexander II, he returned in 1856 to resume his literary activity. His first novel, *Poor People*, came out in 1846. Among his works that have appeared in English are: *Crime and Punishment*; *Injury and Insult*; *The Friend of the Family*; *The Gambler*; *The Idiot*; *Prison Life in Siberia*; *Uncle's Dream*; *The Permanent Husband*; *The Brothers Karamzov*; *Letters from the Underworld and Other Tales*. There is a complete edition of his novels by C. Garnett, 1912.—BIBLIOGRAPHY:

J. A. T. Lloyd, *A Great Russian Realist*; J. M. Murry, *F. Dostoevsky: a Critical Study*.

**Dot'terel** (*Eudromias morinellus*), a species of plover which breeds in the north of Europe, and returns to the south for the winter. In Scotland it appears in April and leaves in August, the young being hatched in July, but comparatively few breed in the British Islands. It is found all over Europe and Northern Asia. The dotterel is about 8 inches long. Contrary to the general rule the hen is larger and more brightly coloured than the cock, and the latter performs most of the duties of incubation.

**Douai** (dō-ā), town, France, department of Nord, on the Scarpe, 18 miles south of Lille. It is one of the oldest towns in France, of which it became part by the Treaty of Utrecht. It is strongly fortified, has a fine town-house, several handsome churches, an academy of arts and law, a lyceum, museum and public library, Benedictine college, and hospital; a cannon foundry, linen manufactories, machine-works, and tanneries. There was long here a college for British Roman Catholic priests, the most celebrated of its kind, founded by Cardinal Allen in 1568. Douai was captured by the Germans during the European War, and retaken by the Allies in Oct., 1918. It received the Cross of the Legion of Honour in Sept., 1919. Pop. 36,314.

**Douai Bible**, the English translation of the Bible used among English-speaking Roman Catholics, and executed by divines connected with the English College at Douai. The New Testament was published in 1582 at Rheims, the Old during 1609-10 at Douai, the translation being based on the *Vulgate*. Various revisions have since materially altered it.

**Douarnenez** (dy-ār-né-nā), a seaport, France, Finistère, on a beautiful bay of the same name, 13 miles north-west of Quimper. It depends chiefly on the sardine fishery. Pop. 18,752.

**Double Fertilization**. See *Embryo-sac*.

**Double-flowering**, the development, often by cultivation, of the stamens and pistils of flowers into petals, by which the beauty of the flower is enhanced and its reproductive powers sacrificed.

**Double-insurance**, the effecting of two insurances upon the same goods. In marine insurance it is lawful for a shipper to insure his goods twice, but only to give an additional security in the event of the failure of the first underwriters. In the event of a loss it is ultimately divided among the underwriters in the ratio of the risks they have taken.

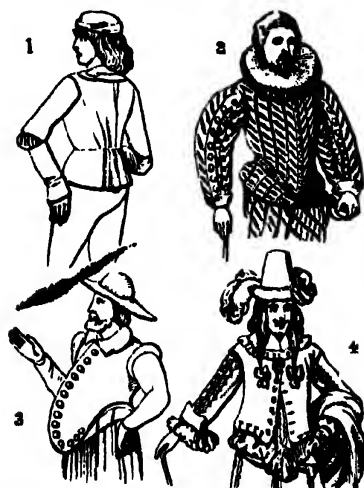
**Double-stars**, or **Binary Stars**, stars which are so close together that they appear as one to the naked eye, but are seen to be double when viewed through a telescope. One of these stars may revolve about the other, or, more accurately



speaking, both revolve round the common centre of gravity.

**Doublet**, a close-fitting garment, covering the body from the neck to a little below the waist. It was introduced from France into England in the fourteenth century, and was worn by both sexes and all ranks until the time of Charles II, when it was superseded, as far as men were concerned, by the coat and waistcoat. The garment got its name from being originally lined or wadded for defence.

**Doublet**, in lapidary work, a counterfeit stone composed of two pieces of crystal, with a colour between them, so that they have the same



1, Doublet, time of Edward IV. 2, 3, Doublets, time of Elizabeth. 4, Doublet, time of Charles I.

appearance as if the whole substance of the crystal were coloured.

**Double-vault**, in architecture, one vault built another so that a space is left between the

o. It is used in domes or vaulted roofs when the external and internal arrangements require vaults differing in size or shape, the outer and upper vault being made to harmonize with the exterior of the building, the inner or lower with the interior.

**Doublon'**, a gold coin of Spain and of the Spanish American States, originally double the value of the pistole. The doubloon of Spain was subsequently equivalent to about a guinea sterling. The doubloon of Chile was worth about 18s. 9d. sterling; that of Mexico, £3, 4s. 8d.

**Doubs (dô)**, a department of France, having Switzerland on its eastern frontier. Its surface is traversed by four chains of the Jura. The temperature is variable, and the climate somewhat rigorous. About a third of the land is arable, but much the greater part is covered with forests. Maize, potatoes, hemp, flax are

the principal crops. Much dairy produce is made into Gruyère cheese. The minerals include iron, lead, and marble. Pop. 284,975.—The River Doubs rises in the department to which it gives its name, flows first north-east, then north-west till it joins the Saône at Verdun-sur-Saône; length, 250 miles.

**Douche (dôsh)**, a jet or current of water or vapour directed upon some part of the body; employed in bathing establishments. When water is applied, it is called the *liquid douche*, and when a current of vapour, the *vapour douche*.

**Douglas (dug'las)**, a family distinguished in the annals of Scotland. Their origin is unknown. They were already territorial magnates at the time when Bruce and Baliol were competitors for the crown. As their estates lay on the borders they early became guardians of the kingdom against the encroachments of the English, and acquired in this way power, habits, and experience which frequently made them formidable to the Crown. We notice in chronological succession the most distinguished members of the family. James, son of the William Douglas who had been a companion of Wallace, and is commonly known as the Good Sir James, early joined Bruce, and was one of his chief supporters throughout his career, and one of the most distinguished leaders at the battle of Bannockburn. He was called 'Black Douglas' from his swarthy complexion. He fell in battle with the Moors while on his way to the Holy Land with the heart of his master, in 1331.—Archibald, youngest brother of Sir James, succeeded to the regency of Scotland in the infancy of David. He was defeated and killed at Halidon Hill by Edward III in 1333.—William, son of the preceding, was created first earl in 1357. He recovered Douglasdale from the English, and was frequently engaged in wars with them. He fought at the battle of Poitiers and died in 1384.—James, the second earl, who, like his ancestors, was constantly engaged in border warfare, was killed at the battle of Otterburn in 1388. After his death the earldom passed to an illegitimate son of the Good Sir James, Archibald the Grim, Lord of Galloway.—Archibald, son of Archibald the Grim and fourth earl, was the Douglas who was defeated and taken prisoner by Percy (Hotspur) at Homildon 14th Sept., 1402. He was also taken prisoner at Shrewsbury 23rd July, 1403, and did not recover his liberty till 1407. He was killed at the battle of Verneuil, in Normandy, in 1427. Charles VII created him Duke of Touraine, which title descended to his successors. He was surnamed 'The Tyneman', or loser, on account of his many misfortunes in battle.—William, sixth earl, born 1422, together with his only brother David was assassinated by Crichton and Livingstone at a banquet to which

he had been invited in the name of the king, in Edinburgh Castle, on 24th Nov., 1440. Jealousy of the great power which the Douglasses had acquired from their possessions in Scotland and France was the cause of this deed.—William, the eighth earl, a descendant of the third earl, restored the power of the Douglasses by a marriage with his cousin, heiress of another branch of the family; was appointed Lord-Lieutenant of the kingdom, and defeated the English at Sark. Having entered into treasonous league, he was invited by James II to Stirling and there murdered by the king's own hand, 22nd Feb., 1452.—James, the ninth and last earl, brother of the preceding, took up arms with his allies to avenge his death, but was finally driven to England, where he continued an exile for nearly thirty years. He entered Scotland on a raid in 1484, but was taken prisoner and confined in the abbey of Lindores, where he died in 1488. His estates, which had been forfeited in 1455, were bestowed on the fourth Earl of Angus, the 'Red Douglas', the representative of a younger branch of the Douglas family, which continued long after to flourish. The fifth Earl of Angus, Archibald Douglas, was the celebrated 'Bell-the-Cat', one of whose sons was Gawin Douglas the poet. He died in a monastery in 1514. Archibald, the sixth earl, married Queen Margaret, widow of James IV, attained the dignity of regent of the kingdom, and after various vicissitudes of fortune, having at one time been attainted and forced to flee from the kingdom, died about 1560. He left no son, and the title of Earl of Angus passed to his nephew David. James Douglas, brother of David, married the heiress of the Earl of Morton, which title he received on the death of his father-in-law. His nephew, Archibald, eighth Earl of Angus and Earl of Morton, died childless, and the earldom of Angus then passed to Sir William Douglas of Glenbervie, his cousin, whose son William was raised to the rank of Marquess of Douglas. Archibald, the great-grandson of William, was raised in 1703 to the dignity of Duke of Douglas, but died unmarried in 1761, when the ducal title became extinct, and the marquessate passed to the Duke of Hamilton, the descendant of a younger son of the first marquess. The line of Angus or the Red Douglas is now represented by the Houses of Hamilton and Home, who both claim the title of Earl of Angus.—BIBLIOGRAPHY: David Hume of Godscroft, *A History of the House of Douglas and Angus*; Sir H. Maxwell, *A History of the House of Douglas*.

Douglas, Gawin, an early Scottish poet of eminence. He was the son of Archibald, fifth Earl of Angus, and was born at Brechin about 1474. He received a liberal education, com-

menced at home and completed at the University of Paris. On returning to Scotland he took orders in the Church, and ultimately became Bishop of Dunkeld, through the influence of his nephew, the sixth Earl of Angus, who married Queen Margaret, widow of James IV. He died of the plague in 1522 in London, where he had been obliged to take refuge on account of political commotions. He translated Virgil's *Æneid* into verse with much spirit and elegance, prefixing original prologues to the different books of the original. This was the first poetical translation into English of any classical author. It was written about 1512, and first published in 1553. He also wrote *The Palace of Honour* and *King Hart*, both allegorical poems.—Cf. J. H. Millar, *Literary History of Scotland*.

Douglas, Sir Howard, Baronet, G.C.B., a British general, born in 1770, the son of Admiral Sir Charles Douglas. He served in Spain in the Peninsular War, and acquired much reputation by his writings on military subjects, especially by his *Military Bridges and the Passage of Rivers* (1816), and *Treatise on Naval Gunnery* (1819). From 1823 to 1829 he was Governor of New Brunswick, and from 1835 to 1842 Lord High Commissioner of the Ionian Islands. He attained the rank of general in 1851, and died in Nov., 1861.

Douglas, Stephen Arnold, American politician, born in Vermont, 1813, died 1861. Having gone to Jacksonville, Illinois, he became an attorney, was appointed Attorney-General for the State, and in 1843 was elected a member of the United States House of Representatives. In 1847 he was elected to the Senate, and by re-election was a member of this body till his death. He was especially prominent in connection with the question as to the extension of slavery into new states and territories, which he maintained was a matter to be settled by the people of respective states or territories, and not by Congress. He was a presidential candidate in 1860, when Lincoln was elected.

Douglas, Sir William Fettes, painter, born in Edinburgh 1822, died in 1891. He was educated at the High School in that city, spent ten years in a bank before finally deciding (in 1847) upon the artist's profession. In 1851 he was elected an Associate of the Royal Scottish Academy, and three years later a full member. In 1877 he became Curator of the National Gallery of Scotland, resigning the post in 1882 on his election as president of the Royal Scottish Academy. Among the finest of his early pictures are: *Bibliomantia* (1852, in the National Gallery), *The Ruby Ring* (1853), *The Alchemist* (1855), *Iludibras and Ralph visiting the Astrologer* (1856), and *The Rosicrucian* (1856), many of these showing much of the Pre-Raphaelite

spirit, with abundance of detail. After 1870 he devoted himself rather to landscape, and his *Stonehaven Harbour* and *A Fishing Village* (1874-8) are perhaps his masterpieces. He was knighted in 1882.

Douglas (dug'las), capital of the Isle of Man, is situated on the south-east coast, on a beautiful semicircular bay. It is frequented by immense numbers of visitors during the summer. Among the objects of interest are the House of Keys, the custom-house, the extensive breakwater, and the promenade. Pop. 21,192.

Douglas, Frederick, American lecturer and journalist, was born at Tuckahoe, in Maryland, about 1817. His father was a white man, but his mother being a negro slave, he was, according to the law, reared as a slave. In 1832 he was purchased by a Baltimore shipbuilder, but made his escape in 1838. As he had taught himself to read and write, and showed talent as an orator, he was employed by the Anti-slavery Society as one of their lecturers. In 1845 he published his autobiography, and afterwards made a successful lecturing tour in England. In 1870 he started a journal entitled *The New National Era*; in 1871 he was appointed secretary of the Commission to Santo Domingo; in 1877 Marshal for the district of Columbia, then Commissioner of Deeds, and eventually Minister to Hayti. He died in 1895.

Doulton (döl'tun), Sir Henry, 'the greatest potter of the nineteenth century', born in Lambeth in 1820, died in 1897. On leaving University College School, in 1835, he joined his father, who had carried on a small pottery since 1815, and began by perfecting himself in all the mechanical processes then used by potters. He scored his first distinct success in 1840 with glazed drain-pipes, and in 1851 and 1862 the firm obtained medals for stoneware vessels and chemical apparatus. At the South Kensington Exhibition in 1871 a striking display was made of the new Doulton artistic ware. Doulton exhibited at Vienna in 1873, and at Paris five years later, when he was made a chevalier of the Legion of Honour. He then established a school of artists in connection with his manufactory, with the object of promoting originality in design. He received the Albert gold medal of the Society of Arts in 1885, and was knighted at the Jubilee two years later.

Doum Palm (döm), a palm tree, *Hyphæne thebaica*. It is remarkable, like the other species of the genus, for having a repeatedly branched stem. Each branch terminates in a tuft of large fan-shaped leaves. The fruit is about the size of an apple; it has a fibrous mealy rind, which tastes like gingerbread (whence the name *ginger-bread tree* sometimes applied to this palm), and eaten by the poorer inhabitants of Upper

Egypt, where it grows. An infusion of the rind is also used as a cooling beverage in fevers. The seed is horny, and is made into small ornaments. Ropes are made of the fibres of the leaf-stalks.

Doune (dön), a police borough in W. Perthshire, Scotland, on the River Teith, 9 miles north-west of Stirling, once famous for its manufacture of Highland pistols and sporrans. The old ruined castle—an imposing structure now partially repaired—is described in Scott's *Waverley*. Pop. 890.

Douro (dô'rô), one of the largest rivers of the Spanish Peninsula, which, flowing west, traverses



Doum Palm (*Hyphæne thebaica*)

about one-half of Spain and the whole of Portugal, and, after a course of 500 miles, falls into the Atlantic 3 miles below Oporto. It is navigable for small vessels for about 70 miles.

Dove. See *Turtle-dove* and *Pigeon*.

Dove (dôv), a river, England, Derbyshire, which, after a course of 39 miles through highly picturesque scenery, falls into the Trent.

Dove-cotes. Pigeon-keeping to provide a food-supply is a practice of considerable antiquity, and dove-cotes are found in many quarters of the world. Those introduced into Britain by the Normans were modelled on the Roman *columbarium*, a massive circular structure, lined with nest-holes, and having a domed roof. A fine example of this type, built 1326, survives at Garway, Herefordshire. Till towards the end of the sixteenth century, these buildings, numbering some 20,000, formed items of manorial privilege in England, and were long confined to

Scottish baronies. About this period square and octagonal forms became common, a fine brick specimen of the latter style remaining at Whitehall, Shrewsbury. In Scotland typical 'doo'-cots' exist in the Edinburgh suburbs of Liberton and Corstorphine. That at Liberton, a type common in Scotland but rare in England, is oblong, with lean-to roof and two compartments—probably to avoid disturbing the whole flock when 'squabs' were taken from the nests. Dove-cotes fell generally into disuse when the introduction of 'roofs' insured the winter feeding of farm-stock and a consequent steady supply of fresh meat; but their antiquarian interest and frequent beauty call for the careful preservation of existing specimens.

**Dove Deities.** The cult of the dove is of great antiquity. In Crete and at Mycenæ, and in the area of Hittite control in Asia Minor, it was connected with the Mother-goddess. The bird appears in archaic clay figurines from Myruiclia, Rhodes, Delos, Athens, and Etruria. Whether or not the dove cult originated in Crete or Asia Minor is uncertain. Some think it is of Egyptian origin, but there is no trace of a dove goddess in Nilotic art. In the love poems found in Egyptian tombs, however, the dove is referred to, being in one case addressed by a lover, who asks it if love is to be denied to her; she then tells the dove that she has found her chosen one and is happy by his side. The pigeon was protected in Egypt, and is still regarded as a 'luck bird', and it may have been connected with ancient folk religion. In Babylonia and Assyria the dove was associated with the goddess Ishtar, but not specially during the earlier periods. The Allatu bird is, however, referred to in the Gilgamesh epic, and Pinches has translated the suggestive reference in an Ishtar hymn, *Like a lonely dove I rest*. In another hymn the worshipper moans like a dove. According to Diodorus, the famous Assyrian Queen Semiramis, who was abandoned after birth, was protected and fed by doves. In Crete two forms of the Great Mother-goddess, who was an Aphrodite in one of her phases, were the snake goddess and the dove goddess. Two doves appear on a model of a Mycenaean shrine. The dove is associated with the Hittite goddess at Marash, Yurre, and Fraktin. It is sometimes found with the nude Syrian goddess. Lucian states, in reference to a Syrian cult, that the dove is the holiest bird (*De Dea Syria*, chapter liv), and that there was a golden dove in the temple, but nothing was known regarding its origin, some referring it to Dionysus, some to Deukalion, and some to Semiramis (a name said to mean mountain dove) (chapter xxxiii). Elian tells that the dove was the sacred companion of Astarte (*Hist. Nat.*, iv, 2). Like the Egyptians, the Semites re-

garded the pigeon with veneration. The Hebrews sacrificed it on special occasions (*Num.* vi, 10; *Lev.* xiv, 4, 49). Noah sent out a dove from the ark (*Gen.* viii, 8). A prophet mourns as a dove (*Is.* xxxviii, 14). The dove is 'silly' (*Hos.* vii, 11). Doves were sold in the temple (*Mark.* xi, 15). The Spirit of God appears as a dove (*Matt.* iii, 16). According to Herodotus, the Persians drove away white pigeons, connecting them with leprosy (*Book I*, 139). At Dodona, the famous sanctuary in Epirus, auguries were taken from the moaning of doves in the tree-tops, and the priestesses of Zeus were called doves (*Peleiad*). Doves and pigeons were mystical birds in the British Isles. In England it was believed that one could not die on a bed of pigeon feathers, and the dying person had, therefore, to be removed from one so that the suffering might not be prolonged. The early Christian saints revered the dove. St. Gregory the Great is shown with a dove on his shoulder, and the emblem of St. Remigius is a dove with an oil-curse in its beak. A snow-white dove with golden bill was wont to sit on the head of St. Mungo, the patron saint of Glasgow. Stories used to be told of sick persons recovering on seeing a white dove on an altar. In the folk lore attached to the memory of Michael Scott, the dove is connected with heaven, and the raven with hell. St. Columba's name signifies 'Dove'. Dove-cotes were connected with old churches, especially in England.

**Dover**, a municipal borough of England, county of Kent, 67 miles south-east of London. It lies on the coast of the Straits of Dover, and is 21 miles distant from Calais on the French coast. It is an important railway terminus, and as a port for mail and packet service with the Continent has a large passenger traffic. Ship-building, sail-making, and fisheries are carried on. There are two docks and a tidal harbour; an outer harbour of 70 acres, enclosed by a new pier and the extended Admiralty Pier, completed in 1871. Very extensive harbour improvements, begun in 1898, were carried out in subsequent years. The celebrated castle stands on a high chalk cliff. Dover is the chief of the Cinque Ports, and has extensive barracks. A parliamentary borough till 1918, Dover now gives its name to a parliamentary division of Kent. Dover was frequently raided by German aviators during the European War. Pop. 43,645.

**Dover**, a city of the United States, in New Hampshire. It is situated on both sides of the Cochecho, which has here a fall of over 30 feet, affording abundant water-power for the large iron and cotton manufactories. Pop. 13,247.

**Dover, Straits of**, the narrow channel between Dover and Calais which separates Great Britain from the French coast. At the narrowest

part it is only 21 miles wide. The depth of the channel at a medium in the highest spring-tides is about 25 fathoms. On both the French and English sides the chalky cliffs show a correspondence of strata which leaves no room for doubt that they were once united, a fact which is clearly shown by many other proofs.

**Dover's Powder**, a preparation frequently used in medical practice to produce perspiration. It consists of 1 grain of opium, 1 of ipecacuanha, and 8 of sulphate of potash in every 10 grains, which constitute a full dose. It is named after Thomas Dover, an English physician of the eighteenth century.

**Dovre-Fjeld** (dō-vre-fyel), an assemblage of mountain masses in Norway, forming the central part of the Scandinavian system, and extending as a plateau 2000 feet high E.N.E. from lat. 62° N. to lat. 63°. It is generally composed of gneiss and mica schist. One of the mountains belonging to it is Snchaetta, 7620 feet.

**Dow**, Gerard, an eminent painter of the Dutch school, was the son of a glazier, and born at Leyden in 1613. He studied under Rembrandt, and united his master's manner in chiaroscuro with the most minute finish and delicacy. Among his pictures, generally of small size and mostly scenes of family life, are: *The Evening School*, *Young Mother*, *Woman Sick with Dropsy*, and *The Bible Reader*. Dow died in 1675.

**Dowden**, Edward, English critic, historian, and educator, was born at Cork in 1843, died in 1913. He studied at Queen's College, Cork, and Trinity College, Dublin, where he gained great distinction, especially in English and Philosophy; and in 1867 he was elected to the professorship of English literature in the university. He was the first Taylorian lecturer at Oxford University in 1889, and held the Clark lectureship in English literature at Trinity College, Cambridge, from 1893 to 1896. Besides contributing to periodicals, Professor Dowden published various works on literary subjects, in particular: *Shakspeare: his Mind and Art* (1875); *Shakspeare Primer*; *Studies in Literature*; *Southey*; *Southey's Correspondence with Caroline Bowles*; *Life of Shelley* (2 vols., 1886), the chief authority on the poet's life, being founded on papers in the possession of the Shelley family; *Wordsworth's Poetical Works* (1892-3); *Introduction to Shakspeare* (1893); *New Studies in Literature* (1895); *The French Revolution and English Literature* (lectures delivered at Princeton College, New Jersey, in 1896); *History of French Literature* (1897); *Robert Browning* (1904); *Michel de Montaigne* (1905); *Essays, Modern and Elizabethan* (1910). A volume of poems by him appeared in 1876, and his collected *Poetical Works and Letters* appeared in 1914.

**Dower** (Fr. *douaire*, Lat. *dos*, dower), in English law, is the right which a wife (not being an alien) has in the freehold lands and tenelements of which her husband dies possessed and undisposed of by will. By common law this right amounts to one-third of his estate during her life; by local custom it is frequently greater. Where the custom of *gavelkind* prevails, the widow's share is a half, and that of *free-bench* gives her the whole or a portion of a copyhold, according to the custom of the manor. The term is also applied to the property which a woman brings to her husband in marriage, but this is more correctly *dowry*.

**Dowle**, John Alexander, religious impostor, born at Edinburgh in 1847, died in 1907. Educated at the university of his native town, he joined his family in Sydney, Australia, and entered the ministry as clergyman of the Congregational denomination. In 1878 he started evangelistic work, maintaining that it was wrong to take a minister's salary. In 1882 he established a tabernacle at Melbourne, and began to practise faith-healing. He then came to the United States, where he organized his own Church, establishing it in 1901 at Zion City, 42 miles from Chicago, on the shore of Lake Michigan. He styled himself 'Elijah II', and 'the First Apostle of the Lord Jesus Christ, and General Overseer of the Catholic Apostolic Church'. Suspended in 1906 by his congregation of Zion City, who accused him of tyranny, polygamy, and misuse of funds, he died shortly afterwards.

**Dowlais**, a town of South Wales, Glamorgan-shire, included in the parliamentary borough of Merthyr Tydfil, from which it is distant 1½ miles north-east, with important iron- and steel-works. Pop. 18,112.

**Dowlas**, a kind of coarse linen formerly much used by working people for shirts; this use of it is now generally superseded by calico.—Cf. Shakespeare, *1st Henry IV*, iii, 3.

**Dowletabad**. See *Daulatabad*.

**Down**, a county of Ireland, in Ulster, bounded on the north by Belfast Lough and on the east by the Irish Sea; area, 610,730 acres, of which over five-sixths are productive. Down is copiously watered by the Rivers Ban, Lagan, and Newry, and has numerous small lakes. The surface is very irregular, and in parts mountainous, Slieve Donard, in the Mourne Mountains, being 2796 feet high. Agriculture is in a flourishing condition, oats, wheat, flax, turnips, and potatoes being the principal crops. The native breed of sheep is small, but valued for the delicacy of its mutton and the fine texture of its wool. The principal manufactures are linen and muslin. The fisheries on the coast, principally cod, haddock, and herring, are considerable,

The county has five parliamentary divisions, each returning a member. The county town is Downpatrick; others are Newry, Newtownards, Bangor, and Banbridge. Pop. 204,803.

**Downing College**, one of the colleges of the University of Cambridge, chartered in 1800 and opened in 1821. Its founder was Sir George Downing, a Cambridgeshire gentleman.

**Downing Street**, a street in London, leading from Whitehall. The name is used as a synonym for the British Government, the Foreign Office and Colonial Office being located in it. No. 10 is the official residence of the Prime Minister, and No. 11 that of the Chancellor of the Exchequer.

**Downpatrick**, a market town of Ireland, county town of Down, 21 miles S.E. of Belfast. It is the seat of the diocese of Down, Connor, and Dromore, has a cathedral, and is celebrated as the supposed burial-place of St. Patrick. Pop. 3200.

**Downs**, a term given to undulating grassy hills or uplands, specially applied to two ranges of undulating chalk hills in England, extending through Surrey, Kent, and Hampshire, known as the North and South Downs. The word is sometimes used as equivalent to *dunes* or sand-hills.

**Downs, The**, a celebrated roadstead for ships, extending 6 miles along the east coast of Kent in England, protected on the seaward side by the Goodwin Sands.

**Downton**, a town of England, in Wilts., on the Avon, 6½ miles S.W. of Salisbury; an ancient place, with a large cruciform church in the Norman and later styles, an old earthwork mound called 'the Moat', and an agricultural college. Pop. 1933.

**Doxology** (from Gr. *doxa*, praise, glory, and *logos*), a set form of words giving glory to God, and especially a name given to two short hymns distinguished by the title of *greater* (Glory be to God on high, &c.) and *lesser* (Glory be to the Father, &c.). Both the doxologies have a place in the Church of England liturgy, the latter being repeated after every psalm, and the former used in the communion service.

**Doyen**, Eugène Louis, famous French surgeon, born at Rheims in 1850, died at Paris in 1910. He made numerous discoveries in gynaecological surgery, and in 1895 established a private clinic, where many French and foreign surgeons came to study under him. His surgical methods were adopted, although his claim to have discovered the germ of cancer has been disputed. In 1898 he received the degree of LL.D. from the University of Edinburgh, where he introduced the method of teaching surgery by means of the cinematograph. His works include: *La maladie et le médecin* and *Le Cancer*.

**Doyle**, Sir Arthur Conan, English novelist, a nephew of Richard Doyle, born at Edinburgh, 1859, studied medicine, and for some years practised, but gave up the profession for that of literature. In 1887 he produced *A Study in Scarlet*, in which he created the detective Sherlock Holmes. Among his other books are: *Micah Clarke*, *The Sign of Four*, *The White Company*, *The Adventures of Sherlock Holmes*, *Brigadier Gerard*, *The Great Boer War*, *The Crime of the Congo*, *The Lost World*, *The Poison Bell*, *The British Campaign in France and Flanders*, *The New Revelation*, and *The Vital Message*.

**Doyle**, Sir Francis Hastings Charles, English poet, born 21st Aug., 1810, died 8th June, 1888, was the son of Major-General Sir Francis Hastings Doyle, first baronet, succeeding his father in the title in 1839. Educated at Eton and Oxford, he graduated with first-class honours in classics in 1832, and held a fellowship at All Souls' from 1835 to 1844. After some years' work as a barrister, he became Receiver-General, and in 1869 Commissioner of Customs, having two years previously been elected professor of poetry at Oxford in succession to Matthew Arnold, a position to which he was re-elected for a second term five years later. He had already published *Miscellaneous Verses* (1840); *The Two Destinies* (1844); *The Return of the Guards and other Poems* (1866); and subsequently printed his *Oxford Lectures* (1869 and 1877) and *Reminiscences and Opinions, 1813-85* (1886).

**Doyle**, Richard, an artist, born in London in 1824, died in 1883. He was long well known as a constant contributor of satirical designs to *Punch*, and also showed much talent in illustrations to Leigh Hunt's *Jar of Honey*, Thackeray's *Newcomes* and his *Rebecca and Rowena*, and Ruskin's *King of the Golden River*. Afterwards he devoted himself to water-colour painting.

**Dozy** (dō'zi), Reinhart, Dutch Orientalist and historian, born 1820, died 1883. He was thoroughly versed in most of the Semitic tongues, and spoke and wrote almost all the European languages with facility. Among his works (sometimes in Dutch, sometimes in French) are: *Histoire des Musulmans d'Espagne de 711-1110*, *Géographie d'Edrisi*, *De Israhélien te Mekka*, *Het Islamisme*, *Suppléments aux Dictionnaires Arabes*.

**Draa**, or **Wady Draa**, a river, or rather water-course, of Morocco, rising in the Atlas Mountains and flowing generally south-east, until, after penetrating the Anti-Atlas range and passing several oases, it suddenly turns westwards, and forms the shallow lagoon El Debaia. From this point until it enters the ocean it is a wady, and forms the southern boundary of Morocco.

**Dracæna**, a genus of endogenous evergreen plants, nat. ord. Liliacæ. It includes the



dragon tree of Teneriffe (*D. Draco*), celebrated for producing the resin called dragon's blood. Several species of *Dracæna* are cultivated in greenhouses for the beauty of their foliage, but many of the fine plants known by this name belong strictly to other genera.

**Drachenfels** (dri'h'en-fels; 'dragon rock'), "the castled crag of Drachenfels", as Byron calls it, a hill in Rhenish Prussia, about 8 miles south-east of Bonn, rising 900 feet above the Rhine, and crowned by the old castle of Drachenfels.

**Drachma** (druk'ma), the unit of weight and of money among the ancient Greeks. It was the principal Greek coin, was made of silver, and was worth (the Attic drachma) about 9½d. As a weight amongst the Greeks it was about 2 dwt. 7 grains troy. The monetary unit of modern Greece is also called a drachma. Since 1867 its value has been equivalent to that of the franc of the Latin Monetary Union. It is divided into 100 *lepta*.

**Draco**, a legislator of Athens, about 620 B.C., whose name has become proverbial as an inexorable and bloodthirsty lawgiver, and whose laws were said to have been written in blood, not ink. Suidas says that he met his death at Aigina, being unintentionally suffocated by the caps and cloaks thrown at him by some of his enthusiastic supporters.

**Draco**, the Dragon, a constellation of the northern hemisphere, consisting of a long and straggling line of stars, coiled about Ursa Minor, the Lesser Bear. The Pole of the Ecliptic, or earth's orbital plane, is in this constellation, and round that point the Pole of the Equator, at present close to  $\alpha$  Ursa Minoris (the 'Pole Star'), travels in a circle in about 26,000 years. Some 4000 years ago  $\alpha$  Draconis was pole-star.

**Drag**, (1) a long coach or carriage, generally uncovered and seated round the sides; (2) an apparatus for retarding or stopping the rotation of one wheel or of several wheels, in carriages especially; (3) an apparatus, consisting of a frame of iron with a bag-net attached, used to recover articles lost in the water.

**Drag-net**, a net drawn along the bottom of a river or pond to catch fish. The use of drag-nets is usually prohibited in rivers where fish breed, as it takes all indiscriminately.

**Drago Doctrine**, a doctrine formulated by L. M. Drago, an Argentinian jurist and Minister for Foreign Affairs, and asserting the principle that no power had a right to impose itself by force of arms upon any of the Spanish American nationalities. Drago first advanced his doctrine in 1902, when the British, German, and Italian fleets were blockading the Venezuelan coast to compel President Castro to pay certain claims made upon his government.

**Dragomirov**, Mikhail Ivanovitch, Russian

general, born in 1880, died in 1905. He became known as lecturer on military tactics, and was appointed chief of the Russian general staff at Kiev. During the Russo-Turkish War he distinguished himself at the crossing of the Danube at Sistova, and was wounded at the Shipka Pass. Retired from active service, he was director of the War Academy at St. Petersburg, Governor-General of Kiev from 1898 to 1902, and member of the Council of the Empire. His works include: *The Austro-Prussian War, A Study on the Novel 'War and Peace', The French Soldier, War is an Inevitable Evil*, and *Duels*.

**Dragomirov**, Vladimir, son of the former, was prominent as a commander during the European War, and took part in the offensive in Galicia in 1916. In 1919 he was president of General Denikin's Political Council, and Governor of Kiev.

**Dragon** (Gr. *drakon*, 'the seeing one', a serpent). This 'composite wonder beast' is prominent not only in fairy lore and mediæval romances, but in ancient religious systems. In the mythical history of the East the dragon is the symbol of anarchy and destruction, and the idea was taken over by Christianity, which looked upon the dragon as an emblem of the devil. In Ancient Egypt certain of the deities had serpentine forms, as have still some of the dragons of India, China, and Japan. The Egyptian 'fiery flying serpent' is a dragon, as is also the Apep serpent of night and death, through which the sun-barque of Ra was supposed to pass each night. Biblical references to it as the 'worm' include: "Their worm shall not die" (*Is. lxvi, 24*); "The worm shall cut them like wool" (*Is. li, 8*); "In that day the Lord, with his sore, and great, and strong sword, shall punish leviathan the piercing serpent", &c. (*Is. xxvii, 1*); "The great dragon was cast out, that old serpent, he that is called the Devil and Satan" (*Rev. xii, 9*). See also *Ps. lxxxvii, 4*, and *lxxxix, 10*; *Amos, ix, 8*; and *Is. li, 9*. Osiris, as the Nile, was a dragon on which were human heads. In the Pyramid Texts he is addressed as "the Great Green" (the Mediterranean Sea), and the one who is "round as the Great Circle (Okeanos)". On the sarcophagus of Seti I he is "Osiris encircling the Nether World". Set, who slew him, had a 'roaring serpent' form and hid in a hole; he resembled Typhon. The Babylonian dragon Tiamat was the Great Mother of all the deities, and was slain by her descendant Marduk (Merodach), who formed the earth and sky from her body; her blood ran as the flooded rivers to the sea. In India the drought-demon is a water confiner. When slain by Indra with the thunderbolt, the rainy season ensues. The Naga serpent-gods are dragons who may assume human or half-human, half-reptile forms. They

guard treasure and chiefly pearls. Early pearl-fishers believed that the shark was the owner and guardian of pearls. Among the Chinese dragons is the lion-headed shark. All the Chinese dragons have pearls in their mouths, and are supposed to spit out pearls. Dragon deities are connected with the moon, which is 'the night-shining pearl', and in Mexico 'the pearl of heaven'. The Mexican dragon resembles the Chinese, Indian, and Babylonian dragons. The Indian wonder-beast, the *Makara*, the vehicle of the sea-god Varuna, is similar to the dragon of the Babylonian mother-goddess Ishtar seen on the famous Ishtar gate of Babylon. *Makara* forms include the lion-headed dolphin, the crocodile-headed fish, and the ram-headed fish so like the 'goat fish' or 'antelope fish' of the Babylonian sea-god Ea, and resembling the Greek horse-headed, dog-headed, and man-headed fish (Tritons). Japanese dragons are serpentine 'water fathers', which are prayed to in time of drought. The Chinese dragons are rain-bringers which sleep during the winter (the season of drought) in pools and rise to fight and thunder in spring. They are hatched from stones as snakes, or from sea-plants, or are transformed fish, or are born from aged pine trees. They are coloured according to their attributes, and may assume human forms or be horse-headed with a snake's tail. That the composite dragon-god is a mixture of several ancient animal-gods is evident by the following description of one class of dragon by a Chinese writer: "His horns resemble those of a stag, his head that of a camel, his eyes those of a demon, his neck that of a snake, his belly that of a clam, his scales those of a carp, his claws those of an eagle, his soles those of a tiger, his ears those of a cow". Dragons may transform themselves into fishes, snakes, crows, dogs, rats, cows, sharks, whales, crocodiles, &c., as well as human beings. The 'will o' wisp' is the 'dragon lantern', and the dragon pearl is the 'jewel that grants all desires' in India, China, and Japan. Dragon herbs cure diseases and prolong life. Dragons carry souls to the Celestial regions, or draw vehicles in which souls stand. This Far Eastern belief existed in Ancient Crete too. On a Cretan sarcophagus is a chariot drawn by two griffins (forms of the dragon) in which stands a woman, probably a goddess, and a swathed pale figure, the deceased. Shakespeare has interesting dragon references, including:

The dragon wing of night o'er spreads the earth. . . .  
(*Troilus and Cressida*, v, 8, 17.)

Swift, swift, you dragons of the night, that dawn  
May bare the raven's eye.  
(*Cymbeline*, ii, 2, 49.)

It is believed that the treasure-guarding dragon

of the romances had origin in mixed memories regarding the pearl-guarding shark, the fiery flying serpent, and the ancient serpent and crocodile demons of destruction, flood, darkness, and death. The whole idea of dragons may have originated from traditions about the pterodactyls which lived in the Mesozoic period.

The dragon being a symbol of destruction and a power of evil, the slaying of a dragon was considered a great achievement of mediæval heroes, such as King Arthur, Beowulf, Siegmund, and Tristram.—Cf. G. Elliot Smith, *The Evolution of the Dragon*; M. W. de Visser, *The Dragon in China and Japan*.

**Dragon**, or **Dragon-lizard**, a name for several species of lizards inhabiting South-East Asia. The common flying lizard (*Draco volans*), the best type of the genus, is about 10 or 12 inches in length, the tail being extremely long in proportion to the body. The sides are furnished with peculiar extensions of the skin, resembling wings, which help to support it in the air as it springs from branch to branch. These wing-like processes are borne by prolongations of five or six of the hindermost ribs, and can be folded up. Its food consists almost exclusively of insects.

**Drag'onet**, the common name of small marine fishes constituting a special family (Callionymidae). The gemmeous dragonet (*Callionymus lyra*) is found in the British seas. The female is dull brown and much smaller than the male, which is brilliantly coloured with spots and bars of blue on a yellow ground. His first dorsal fin is large and drawn out into a long filament.

**Dragon-fly**, the common name of members of a family (Odonata or Libellulidae) of neuropterous insects. They have a large head, large eyes, and strong horny mandibles. They are beautiful in form and colour, and are of very powerful flight. The great dragon-fly (*Aeschna grandis*) is about 4 inches long, and the largest of the British species. They live on insects, and are remarkable for their voracity. The dragon-fly deposits its eggs in the water, where the wingless nymphs live on aquatic insects. The nymph stage lasts for a year. The family is of very wide distribution. The small blue Agrion is a common European form, but the familiar Libellula is the most extensively distributed. See *Demoiselle*.

**Dragonnades**, or **Dragonades**, the name given to the persecutions directed against the Protestants, chiefly in the south of France, during the reign of Louis XIV, shortly before the revocation of the Edict of Nantes in 1685. Bands of soldiers, headed by priests, marched through the villages, giving the Protestant inhabitants the alternative of renouncing their faith or



being given over to the extortions and violence of the soldiery. The dragoons were conspicuous in these expeditions, to which they gave their name. The Dragonnades drove thousands of



Dragon-fly

A, Larva of dragon-fly. B, Dragon-fly escaping from chrysalis. C, The perfect insect.

French Protestants out of France.—Cf. Tylor, *The Huguenots in the Seventeenth Century*.

**Dragon's Blood**, or **Gum Dragon**, a resinous juice, usually obtained by incision from various tropical plants, as *Calamus Draco*, *Dracaena Draco*, *Pterocarpus Draco*, &c. It varies in composition, and is often much adulterated. It is opaque, of a reddish-brown colour, brittle, and has a smooth shining conchoidal fracture. It is soluble in alcohol and oil, but scarcely so in water. It is used for colouring varnishes, for staining marble, leather, and wood, and for tooth tinctures.

**Dragon Tree** (*Dracaena Draco*), a tree-like liliaceous plant, with a stem simple or divided at top, and in old age often much branched. It is a native of the Canaries, and yields the resin known as dragon's blood. It is often grown in greenhouses.

**Dragoon**, a kind of mounted soldier, so called originally from his musket (*dragon*) having on the muzzle of it the head of a dragon. At one time dragoons served both as mounted and foot soldiers, but now only as the former. In the British army there are *heavy* and *light dragoons*. The first dragoon regiment, the Scots Greys, was formed in 1681.

**Draguignan** (dra-gē-nyān), a town of Southern France since 1793, capital of the department of Var, in a beautiful valley, 41 miles north-east of Toulon. It has some interesting buildings, and manufactures of silk, soap, and leather. Pop. 9974.

**Drainage**. The term comprises the drainage of areas of country by rivers and streams, the reclamation of areas from the sea, and country formerly marshy, and the provision of culverts and pipe-drains to buildings and towns.

The Fens in Lincolnshire are a notable example of a comprehensive system of drainage by means of open ditches (locally called 'drains'), into which the surplus water is lifted by means of wind- and steam-pumps.

Low-lying or flat country often requires a considerable amount of drainage, which is carried out by means of a regular system of earthenware pipes, laid 2 to 3 feet deep, and from 15 to 35 feet apart. These pipes are porous, from 2 to 3



Dragon Tree (*Dracaena Draco*)

1, Fruiting branchlet. 2, Flowers.

inches in diameter, laid with butt joints, and lead into larger mains, and thence by open ditches to streams.

A method recently introduced consists in drawing a pointed cylindrical tool, 2 inches in diameter,

through the ground at the required depth. This tool is dependent from a thin steel plate, which connects it with the carriage above, so that it can be drawn underground in any desired direction. This system is economical in first cost, but its useful life is considerably less than that of a piped drain, and its use is obviously confined to soils of the heavier variety.

In considering the provision of drainage to water-logged or low-lying land, every care should first be taken to improve the existing natural means of drainage, such as deepening and cleaning out streams and ditches, and removing obstructions.

It should be borne in mind that the object of land drainage is not only to remove the surplus water, but to promote a free and natural circulation of water in the soil, and to allow the mineral constituents of the water to reach the plant roots.

In the drainage of buildings, glazed socketed stoneware pipes are used, varying in diameter from 3 to 9 inches, laid straight in plan and in longitudinal section, and laid to falls, calculated to give a minimum velocity of 3 feet per second when flowing half full. These are laid in trenches, with inspection chambers at all changes in direction, and should be laid on and surrounded with concrete. In bad ground, or under dwelling houses, cast-iron pipes are employed, with special turned and bored joints. In towns these drains lead into the public sewers, which are similar stoneware pipes from 6 to 18 inches in diameter, larger sizes being constructed in brickwork or concrete, and either circular or egg-shaped form. In populous areas these sewers attain very large dimensions, the northern outfall sewers of London consisting of five parallel sewers, each 9 feet in diameter. See *Draining*.—BIBLIOGRAPHY: G. S. Mitchell, *Handbook of Land Drainage*; Moore and Silcock, *Sanitary Engineering*; Gilbert Thomson, *Modern Sanitary Engineering*.

**Drainage Tubes** are fenestrated india-rubber tubes used in surgery to effect the gradual removal of the contents of a suppurating cavity. The inner end of the tube is in the cavity, and the outer end projects above the skin surface, and is usually fixed by a stitch or safety-pin, and covered with suitable dressings.

**Draining**, in agriculture, a method of improving the soil by withdrawing the superfluous water from it by means of channels that are generally covered over. Plants cannot thrive unless there is free circulation of air and water round their roots. The successful practice of draining in a great measure depends on a proper knowledge of the superficial strata, of their situation, relative degrees of porosity, &c. Some strata allow water to pass through them, while others more imper-

vious force it to run or filtrate along their surfaces till it reaches more level ground below. In general, where the grounds are in a great measure flat and the soils of materials which retain the excess of moisture, they require artificial means of drainage to render them capable of yielding good crops whether of grain or grass. The wetness of land, which makes it inferior for agricultural purposes, may appear not only as surface-water but as water which flows through the lower strata, and to draw off these



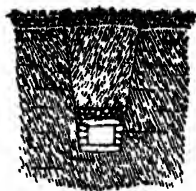
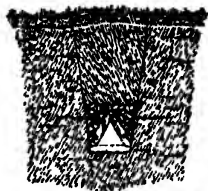
Covered Drain without Pipes

there are the two distinct operations of surface-draining and under-draining. The rudest form of open drains are the deep furrows lying between high-backed ridges, and meant to carry off the surplus water after the soil is completely saturated, but in doing so they generally carry off also much of the best of the soil and of the manure



Open Drain

which has been spread upon it. The ordinary ditch is a common form of water-course useful in certain cases, as in hill pastures. But covered drains at a depth of 4 feet or so are the common forms in draining agricultural lands. They are generally either *stone-drains* or *tile-drains*. Stone-drains are either formed on the plan of open



Stone-laid Drains

culverts of various forms, or of small stones in sufficient quantity to permit a free and speedy filtration of the water through them. The box-drain, for instance, is formed of flat stones neatly arranged in the bottom of the trench, the whole forming an open tube. In tile-drains, tiles or pipes of burnt clay are used for forming the conduits. They possess all the qualities which are required in the formation of drains, affording

a free ingress to water, while they effectually exclude earth, as well as other injurious substances, and vermin. Drainage tiles and pipes have been made in a great variety of forms, the earliest of which, since the introduction of thorough draining, was the horse-shoe tile, so called from its shape. These should always rest on soles, or flats of burned clay. Pipe tiles, which combine the sole and cover in one piece, have been made of various shapes, but the best form appears to be the cylinder. An important department of draining is the draining off of the waters which are the sources of springs. The judicious application of a few simple drains, made to communicate with the watery layers, will often dry swamps of great extent, where large sums of money, expended in forming open drains in the swamp itself, would leave it but little improved. In the laying out of drains the first point to be determined is the place of outfall, which should always afford a free and clear outlet to the drains, and must necessarily be at the lowest point of the land to be drained. The next point to be determined is the position of the minor drains. In the laying out of these the surface of each field must be regarded as being made up of one or more planes, as the case may be, for each of which the drains should be laid out separately. Level lines are to be set out a little below the upper edge of each of these planes, and the drains must then be made to cross these lines at right angles. By this means the drains will run in the line of the greatest slope, no matter how distorted the surface of the field may be. All the minor drains should be made to discharge

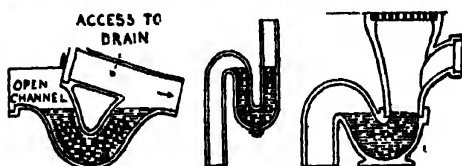


Horse-shoe and Cylindrical Drain Tiles

obliquely into mains or submains, and not directly into an open ditch or water-course. As a general rule, there should be a main to receive the waters of the minor drains from every 5 acres. The advantages of drainage are obvious. In the first place it brings the soil into a more suitable condition for the growth of plants, aiding in producing the finely divided and porous state which allows the roots and rootlets to spread themselves at will in order to obtain the needed supplies of food, air, and moisture. It also allows the sun's rays to produce their full effect on the soil and plants. In the presence of stagnant water a great part of

this effect would be lost. See *Drainage*.

**Drain-trap**, a contrivance to prevent the escape of foul air from drains, while allowing the passage of water into them. They are of various forms. In the traps represented below it will be seen that there must always be a certain quantity of water maintained to bar the way against the escape of the gas from the drain or sewer. When additional liquid is conveyed to



Drain-traps

the trap, there is, of course, an overflow into the drain. In older types of drains the gas was prevented from escaping by a metal plate thrown obliquely over the drain mouth and dipping into the water in the vessel beyond it.

**Drake**, Sir Francis, an English navigator, born at Tavistock, in Devonshire, in 1580, or according to some authorities in 1545. He served as a sailor in a coasting vessel, and afterwards joined Sir John Hawkins in his last expedition against the Spaniards (1567), losing nearly all he possessed in that unfortunate enterprise. Having gathered a number of adventurers round him, he contrived to fit out a vessel in which he made two successful cruises to the West Indies in 1570 and 1571. Next year, with two small ships, he again sailed for the Spanish Main, captured the cities of Nombre de Dios and Vera Cruz, and took a rich booty which he brought safely home. In 1577 Drake made another expedition to the Spanish Main, having this time command of five ships. On this the most famous of his voyages Drake passed the Straits of Magellan, plundered all along the coasts of Chile and Peru, sacked several ports, and captured a galleon laden with silver, gold, and jewels, to the value of perhaps £200,000. He then ran north as far as 48° N. lat., seeking a passage to the Atlantic, but was compelled to return to Port San Francisco on account of the cold. He then steered for the Moluccas, and holding straight across the Indian Ocean doubled the Cape of Good Hope, and arrived at Plymouth 3rd Nov., 1580, being thus the first of the English circumnavigators. As there was no war between England and Spain, the proceedings of Drake had a somewhat dubious character, but the queen maintained that they were lawful reprisals for the action of the Spaniards, and showed her favour to Drake by knighting him on board his own ship. Five years afterwards Drake was again attacking the Spaniards in the

Cape Verde Islands and in the West Indies, and in 1588 particularly distinguished himself as vice-admiral in the conflict with the Spanish Armada. In 1593 he represented Plymouth in Parliament. His later expeditions, that in 1595 against the Spanish West Indies and that to Panama, were not so successful, and his death, which took place on 28th Jan., 1596, at sea off Porto Bello, was hastened by disappointment. —BIBLIOGRAPHY: Sir J. S. Corbett, *Sir Francis Drake* (English Men of Action Series), and *Drake and the Tudor Navy*.

**Drakenberg Mountains**, a range of South Africa forming the western frontier of Natal, and rising to the height of 11,000 feet, a continuation of the Quathlamba range.

**Drama** (Gr. *drama*, action, from *drân*, to act or do), a form of art which imitates action by introducing real persons to represent the fictitious characters, and to carry on the story by means of action and dialogue.

Man is naturally an imitative animal, and some crude form of drama must have been in existence in very early times. We can see the origins of drama in many of the games played by children, where important events such as war, marriage, and sacrifice are represented in song and dance. In Greece, the cradle of drama as of everything that is good, there must have been in prehistoric times war-dances which formed the basis of tragedy, and rough vintage revel dances which formed the basis of comedy.

**Greek Drama.**—The Greek drama was religious in its origin. It arose from the dithyrambs or songs composed in honour of Dionysus, the god of all vegetation, though identified most closely with the vine. When vegetation died in winter, this was considered to be the death of Dionysus; when it bloomed anew in the spring, this was thought to be the god's resurrection. The one event was celebrated with gloomy song and dance, and the other with merry revels and crude indecency. The history of Greek drama is the history of the decline and fall of the chorus. At first the chorus was the whole play, and in the *Suppliants* of Æschylus, the earliest extant tragedy, the chorus played a predominating part. According to tradition, Thespis (about 535 B.C.) introduced for the first time a masked actor, who carried on a dialogue with the leader of the chorus. Æschylus introduced a second actor, and Sophocles a third. It is thought that there never were more than three actors, but, of course, duplication of parts was permitted. There were also frequently mute characters (*kôpha prosôpa*) on the stage. Dialogue became more important in the later plays of Æschylus, and chorus became less important; Sophocles developed his dialogue in a masterly style, though his choruses are among the most beautiful things in all Greek

poetry; in Euripides the choruses, however lovely in themselves, are less an integral part of the drama than they were in the plays of his predecessors. In fact the chorus acted as a clog on the freedom of the dramatist, who wished to develop exciting situations and depict realistic characters. In comedy the same decline of the chorus is to be found; in the *Acharnians*, the earliest comedy, the chorus is very prominent; in the *Plutus*, the last comedy extant, it is comparatively unimportant. Sumptuary laws had something to do with this, and there is a vast difference between the magnificently apparelled chorus in the *Birds*, and the chorus in the *Lysistrata*, which represented elderly Athenian men and women in their everyday costume.

Greek tragedies were usually presented in the form of trilogies, that is, in sets of three plays all dealing with the same subject. To these was added, as a rule, a fourth play, known as a satyr-play. The *Cyclops* of Euripides is the only example extant of this kind of play. It is not very amusing, though it contains a certain amount of horse-play and high spirits. The satyr-play was intended to lighten the gloom of the three preceding tragedies. We have one complete trilogy preserved—the magnificent *Oresteia* of Æschylus, consisting of the *Agamemnon*, *Choephora*, and *Eumenides*—plays which are bracketed with *Lear* and *Othello* as the highest and most majestic of all tragedies. In later times the three plays of the trilogy dealt with different subjects. The tragedies to be performed were carefully selected by some of the Athenian magistrates, and at the festival prizes were given for the best tragedy, on the recommendation of a carefully chosen jury. Comedies were presented one at a time; prizes were offered for the best of them also. Greek tragic actors wore long flowing robes, and added to their height by means of the *cothurnus* or thick-soled boot; it is believed that they wore masks with some sort of speaking-trumpet in the mouth, so that their words would be audible to the vast audience which assembled in the theatre, a huge circular open-air amphitheatre.

Each of the three Greek tragic writers whose work has been preserved is supreme in his own way. Æschylus's lyric dramas are among the greatest writings of all time; the plays of Sophocles are masterpieces of deft construction, of well-woven plot, and ironic dialogue; and his choruses are lyrics of the greatest beauty. Æschylus is more titanic; Sophocles is more humane. Euripides, the latest of the three, is a great poet and a champion of the weak, such as women and slaves; moreover, he sees deeply into men's hearts. He is really the founder of romantic drama, through the Roman Seneca, who imitated him. Of Greek comic poets we

only possess one, but he is a host in himself. Aristophanes is a Gargantuan mirth-maker; he bestrides the narrow world like a Colossus. He plays with a master's hand upon every note in the whole comic gamut. His works, owing to the conditions of the old comedy, were very frequently political and highly personal in their tone. The later plays are less so. The *Birds*, *Clouds*, and *Frogs* are among the very greatest comic creations; only a little less great is the *Lysistrata*, where a serious purpose is veiled by intense indecency. The old comedy, however, was essentially the product of its own age; it did not invite, or even permit, imitation. The new comedy, of which Philemon, Menander, and Diphilus were the principal writers, gradually supplanted it. Their plays were more or less romantic comedies with carefully constructed



A type of mask worn by the characters in a Roman play after Terence's time. The audience knew from the mask the particular character the actor represented.

plots. They are all lost, but we may gain some idea of them from Plautus and Terence, and from the fragments which have been found, some of them fairly recently.

**Roman Drama.**—Roman drama is not intrinsically good; it is in many respects a weak imitation of Greek drama, but it has been very much more important in its influence. Early English, French, and Italian dramatists all turned to Seneca as a model for tragedy, and to Plautus and Terence as models for comedy. This was partly due to the fact that though most of them had small Latin, they had less Greek; but it was partly because the Latin writers were easier to imitate. Italy had native farces, known as Atellan Fables, which were not without their influence on the development of comedy. These plays were broadly farcical, and dealt almost entirely with country life. The two great Roman comedy writers, Plautus and Terence, based their work, however, upon the new comedy of Greece, especially upon the plays of Menander and Diphilus. Plautus is decidedly coarse at times, and sometimes his fun is too much like that of a fourth-form boy at a public school, but his work is wholesome and vigorous, and he

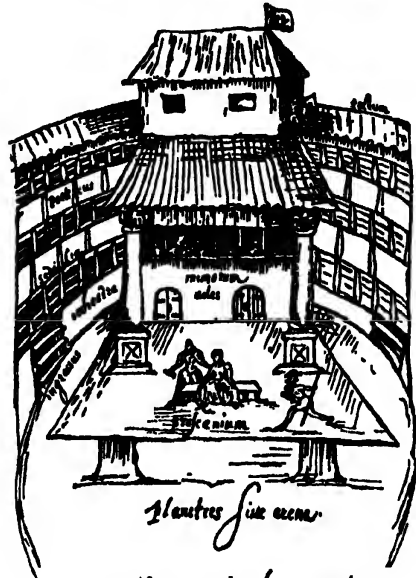
is a more creative and virile writer than Terence. Terence's plays are somewhat weak dramatically, but are written in a style of great beauty. He was a careful literary craftsman. Seneca, the only Roman tragic writer, had an immense influence on later dramatists. It is hard to account for this. He based his work upon Euripides, but he suppressed everything that makes Euripides tender and human. Senecan tragedy abounded in bloodshed and horrors; the speeches are full of pompous rant, and their metre is most monotonous. Some of the choruses are good rhetorical writing, though scarcely great poetry. Seneca's influence pervades all our early tragedy; it is clearly seen in *Gorboduc* and in Jonson's *Sejanus* and *Catiline*; even Shakespeare is not without traces of it. As the Roman Empire declined so did the Roman stage; finally nothing was performed save pantomime, in the proper sense of the word, where everything was done in dumb-show. This appeared to content the populace of the Roman Empire, even as the cinema seems to satisfy the citizens of a later and perhaps greater empire.

**Medieval Drama.**—There is no drama between the death of Seneca and the Renaissance, unless we except the six curious 'comedies' of the nun Hrosvitha of Gandersheim (born about A.D. 935). These plays are based upon Terence, though they do not follow their model closely. They are, of course, written in Latin. They have some vivid dramatic touches, and frequent felicities of expression. They were probably intended for recitation, not for representation on the stage. They must be regarded as an isolated phenomenon. The Church for long discouraged drama, but ended by adapting it to its own purposes. As in Greece, therefore, drama originated in England from religion. The priests impressed certain events in sacred history upon the minds of their congregation by means of dramatic performances which at first took place actually in the church. Thus the removal of the stone from the mouth of the sepulchre and the discovery of the empty tomb was performed at Easter, and the finding of the Babe in the manger by the three Magi was represented at Epiphany. It is easy to understand how performances of this sort arose from the singing of suitable anthems on festival days. The Oberammergau passion-play is a somewhat sophisticated representative of these liturgical plays; it cannot be called a survival, as it only dates back to 1633. These mystery-plays, so called because they were produced by the trade-guilds (Lat. *ministerium*, a trade), were eventually brought out into the market-place on wagons, and were moved round to various 'stations' in the town, different plays being performed at each station. A distinction is sometimes made

between mystery- and miracle-plays, the former being defined as dealing with gospel events only, while the latter deal with incidents derived from the legends of the saints. Several collections of these plays survive—the Wakefield, Chester, and Coventry plays. They are written in a lively fashion, and are often naively humorous, the most sacred Bible characters being introduced along with English yokels and crudely comic persons. The next development of the drama was the morality play or allegory; the well-known *Everyman* is the most finished specimen of this kind of play which we possess. Here personifications of Virtues and Vices formed the dramatis personae; the Devil was usually included in the cast. Moralities were in ways less crude than mysteries, as they consisted of an allegory worked out by means of a more or less continuous plot, while mysteries consisted merely of a series of isolated scenes. The interlude is another early species of drama; it marks a still further advance. Interludes were both farcical and theological in their subjects, and played an important part in the controversies at the time of the Reformation. John Heywood (1497–1580) is the most important writer of interludes, the controversial plays of John Bale (1495–1563) serving to link the interlude to the regular drama, which began gradually to spring up.

**Elizabethan Drama.**—The first English comedy, *Ralph Roister Doister*, appeared in 1551. It is by Nicolas Udall, and is based upon the *Miles Gloriosus* of Plautus. *Gammer Gurton's Needle*, a more native production, thought to have been by John Still, who was master of St. John's College, Cambridge, and Bishop of Bath and Wells, appeared about 1560. Drama now improved rapidly, and was soon to attain perfection in Shakespeare. Marlowe, Kyd, Greene, Lyly, Nash, Lodge, and Peele all helped to prepare the way. The greatest of these is Marlowe, who died at the age of twenty-nine, leaving behind him the great plays *Tamburlaine* (1584) *Faustus*, and *Edward II*. In his development of blank verse he contributed greatly to the success of the drama. The earliest tragedy, *Gorboduc* (1562), is incredibly stiff and wooden in its versification. Marlowe made of blank verse an instrument that would sound any note of pathos or sublimity. In the plays of Shakespeare (1564–1616) drama reached its greatest height. In comedy, tragedy, history, in handling dramatic situations, and in liquid perfection of verse, he is supreme. Like the very greatest masters, he founded no school, and his contemporaries owe little to him. While they are all put in the shade by his myriad-minded genius, they are all partakers with him in the glory of their age, and are all great in themselves. Jonson (1573–1637) is one of the most important, as he to

some extent founded a school and exercised considerable influence over later writers. He was a scholarly and laborious playwright, who over-elaborated some of his work, but who was a masterly adept at constructing a play, and a vigorous realist. Chapman (1569–1634), Dekker (1570–1641), and Marston (1575–1634) were all good workmanlike dramatists. Beaumont and Fletcher produced between them a great body of work, some of inferior quality, but all of great power. In some respects their work is less unlike



Ex observationibus Londinensibus  
Johannes De Witt

Elizabethan Drama

Interior of the Swan Theatre in 1596. From a sketch made by a Dutchman who visited England at the time.

that of Shakespeare than the work of other Elizabethans. Middleton, Webster, Tourneur, Thomas Heywood, and Massinger are all excellent in their way, Massinger in particular being a master of stage-craft. Shirley and Ford conclude the list of the great Jacobean dramatists. The Puritans caused the theatres to be closed in 1642.

**Spanish and French Drama.**—Meanwhile a similar outburst of dramatic activity was taking place on the Continent. In Spain, Lope de Vega (1592–1634) wrote a prodigious quantity of plays, and wrote them with much brilliance. Calderon wrote some beautiful plays, several of which have been translated by Edward Fitzgerald. Cervantes, though much better known as a novelist, wrote many good plays. The Spanish school directly inspired Corneille (1606–1684)



to write his play *Le Cid*, and so begin the great age of classical French tragedy. Racine (1639-1700) is the other great name. French classical drama, though somewhat fettered by its observance of laws that were wrongly considered essential, is extremely dignified and beautiful. In Molière (1622-73) France possesses the greatest of all writers of society comedies. He is as supreme in his kingdom as Shakespeare is in his empire. He borrowed from his predecessors with all the licence of genius, but he paid usurious interest on his borrowings.

**Restoration Drama.**—When the theatres were reopened after the Restoration, many dramatists began to write. Restoration comedy was largely based on Molière, who was brutalized by Wycherley, and adapted but not improved by Congreve. Congreve was, however, a master of sparkling dialogue, and in one play, *The Way of the World*, he has shown himself not unworthy of comparison with his master. Vanbrugh and Farquhar are the other two important writers of comedies; all their comedies are more or less disfigured by cynicism and immorality, the reaction after the Puritan restraint. Restoration tragedy is much less important than Restoration comedy. Otway, Lee, and Southerne are its chief exponents.

**Eighteenth Century Drama.**—Some of these dramatists bring us into the eighteenth century, which was not on the whole prolific in good plays. Fielding wrote many amusing farces, but all were more or less hack-work. At a later period Foote, Cumberland, and the two Colmans wrote good acting plays, which have not lived. The two plays of Goldsmith and several of the plays of Sheridan still hold the stage. Sheridan owed much to the Restoration dramatists, especially Vanbrugh, but as he improved his originals in many respects, and made them much more presentable in decent society, he is entitled to most of the reputation he long enjoyed.

In France, Marivaux (1678-1763) wrote sentimental comedies, while Beaumarchais, whose own life was more exciting and varied than most plays, wrote comedies with brilliant plots. In Italy, Maffei, Goldoni, and Alfieri are notable dramatists; the last named wrote propaganda in the disguise of tragedy. In Germany, Lessing by precept and example inaugurated the 'romantic movement'; Schiller and Goethe are the two greatest names associated with the stage. *Wallenstein* in particular is a good chronicle-play, while *Faust* is considered one of the greatest of all German plays.

**Nineteenth and Twentieth Century Drama.**—Victor Hugo led the Romantic movement in France, and wrote many great plays, such as *Hernani* and *Ruy Blas*. De Musset wrote his plays, which he called *proverbes*, under the same

influence, and later followers of this school are Rostand and the Belgian M. Maurice Maeterlinck. The French dramatists Augier, Scribe, and Sardou had an overwhelming influence on the English stage, not altogether for its good. English drama was at a low ebb in the middle of the nineteenth century. Lytton's plays, though sometimes performed still, are extremely theatrical. Boucicault, who made a great success by dramatizing 'the pathos of Paddy', is not a great writer. H. J. Byron was an inveterate punster and writer of burlesques of no value. One of his plays, *Our Boys*, was acted for many years. Robertson is the most outstanding author of what is known as 'the cup and saucer' school of comedy. His plays are very much acting plays; they are not literature, and are quite removed from real life. Gilbert was a man of great gifts, but though some of his farces and comedies are good, he was not a master of drama as he was of *libretti* writing. He did little to improve the drama of his day. Sir A. W. Pinero began his career as a dramatist under the ægis of Robertson, but continued it under that of Ibsen. Ibsen (1828-1906) exercised a not altogether wholesome influence upon English drama for a considerable time. His plays are extremely well-constructed, and he refused to tolerate many conventions, such as asides and soliloquies. In many of his plays he adopted the retrospective method, where the plot consists not so much in anything being done as in the gradual discovery of what has been done long before the rise of the curtain. Sophocles had done this most skilfully in *Œdipus Tyrannus*, but Ibsen carried the method to perfection in *The Wild Duck* and *Rosmersholm*. All Ibsen's plays are more or less unpleasant, and he did not make many of his characters sympathetic. Pinero, after writing several farces, wrote *The Second Mrs. Tanqueray* (1893), a masterpiece after the style of Ibsen. *His House in Order* is a cleverly constructed example of the retrospective method. H. A. Jones (born 1851) has written many excellent and extremely powerful plays, of which the best known are *The Liars* and *The Case of Rebellious Susan*. G. Bernard Shaw (born 1856), who combines some of the qualities of a Greek sophist with some of the foibles of a modern Irishman, has written some amusing plays, though others have been spoilt by his tendency to turn them into propaganda. Galsworthy has written plays of great earnestness; in some he has neglected the Aristotelian maxim that every play must have a beginning, a middle, and an end. Sir James Barrie has accumulated a large fortune by means of his plays, and in one at least, *Peter Pan*, he has made a bid for immortality.

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**Drammen**, or **Dram**, a seaport of Norway, in a valley on both sides of the Drammen, at its mouth in the Drammensfjord, 25 miles s.w. of Christiania. It has manufactures of leather, soap, ropes, sail-cloth, earthenware, and tobacco; and is the second port in the kingdom for the export of timber.

**Draper**, John William, American chemist and physiologist, born at Liverpool 1811, died 1882. He went to America in 1833, and was successively professor of physical science in Hampden-Sidney College, Virginia, and of natural history, chemistry, and physiology in the University of New York. He made many contributions to scientific literature, and devoted much attention to the chemical action of light, in connection with which he effected some discoveries. Among his chief works is his *History of the Intellectual Development of Europe* (2 vols., 1863). His son, Henry Draper (born 1837, died 1882), chemist and astronomer, made some valuable researches on the spectra of the heavenly bodies.

**Draughts**, a game resembling chess played on a board divided into sixty-four checkered squares. Each of the two players is provided with twelve pieces or 'men' placed on every alternate square at each end of the board. The men are moved forward diagonally to the right or left one square at a time, the object of each player being to capture all his opponent's men, or to hem them in so that they cannot move. A piece can be captured only when the square on the diagonal line behind it is unoccupied. When a player succeeds in moving a piece to the farther end of the board (the crown-head), that piece becomes a king, and has the power of moving or capturing diagonally backwards or forwards. When it so happens that neither of the players has sufficient advantage in force or position to enable him to win, the game is drawn. *Checkers* is the common American name of the game.

The game does not offer the same scope for brilliance and originality as the sister game of

chess, but still is much more profound than is generally supposed. It has been cultivated in Britain, and especially in Scotland, certainly for over two hundred years, and has served as a field of exercise for some extremely able intellects, which but for it might hardly have been exercised at all. Among famous players are: Andrew Anderson, of Carlisle, who published a celebrated work on the game in 1852; James Wyllie, the 'Herd Laddie', who travelled over the world playing exhibition matches, and was for many years world's champion; Robert Martins, English champion about 1870, who played several matches with Wyllie; R. D. Yates, a young American player, who defeated Wyllie for the championship, but shortly afterwards gave up the game; James Ferrie, of Coatbridge, who in 1894 defeated Wyllie and became champion, to be defeated in turn by Richard Jordan of Edinburgh in 1896; Robert Stewart, of Fifeshire, many times Scottish champion, and probably the strongest player now living.

The Scottish tourney, held annually in Glasgow since 1803, except for a few years on account of the War, has done much to stimulate interest in the game. The English Draughts Association also holds a biennial tourney. Several international matches have taken place between Scotland and England, the first in 1884. This, like nearly all the other matches, was won by Scotland. In 1905 a very strong British team visited America and decisively defeated a side representing the United States.—**BIBLIOGRAPHY:** James Lees, *A Guide to the Game of Draughts*. Early works by Payne, Sturges, Drummond, Hay, Anderson, and Bowen are now very scarce. There are several periodicals devoted to the game; and some newspapers, notably *The Glasgow Weekly Herald*, give it a column weekly.

**Drave**, or **Drau** (drá'vé, drou), a European river which rises in Tyrol, flows e.s.e. across the north of Illyria and the south of Styria, and between Hungary on the left and Croatia and Slavonia on the right, and, after a course of nearly 400 miles, joins the Danube 14 miles east of Essek. It is navigable for about 200 miles.

**Dravidian**, a term applied to the vernacular tongues of the great majority of the inhabitants of Southern India, and to the people themselves who inhabited India previous to the advent of the Aryans. The affinities of the Dravidian languages are uncertain. The family consists of the Tamil, Telugu, Canarese, Malayálam, Tulu, Toda, Gond, Rajmahal, Oraon, &c. Only the first four mentioned have a literature, that of the Tamil being the oldest and the most important. Originally the word Dravidian was a purely philological term, but it is now used in an ethnological sense as well.—*Cf.* R. Caldwell,



*Comparative Grammar of the Dravidian or South Indian Family of Languages.*

**Drawback**, usually a certain amount of duties or customs dues paid back or remitted to an importer when he exports goods that he has previously imported and paid duty on, as, for instance, tobacco, &c.; or a certain amount of excise paid back or allowed on the exportation of home manufactures.

**Drawbridge**, a bridge with a lifting floor, such as was formerly used for crossing the ditches of fortresses, or any movable bridge over a navigable channel where the height of the roadway is insufficient to allow vessels to pass underneath. Modern drawbridges across rivers, canals, the entrances of docks, &c., are generally made to open horizontally, and the movable portion is called a basecule, balance, or lifting bridge, a turning, swivel, or swing bridge, or a rolling bridge, in accordance with the mode in which it is made to open. Swing-bridges are usually divided into two parts meeting in the middle, and each moved on pivots on the opposite sides of the channel, or they may move as a whole on a pivot in the middle of the channel. Rolling bridges are suspended from a structure high above the water, and are propelled backwards and forwards by means of rollers.

**Drawing** is the art of representing upon a flat surface the forms of objects, and their positions in relation to each other. The idea of nearness or distance is given by the aid of perspective, foreshortening, and gradation, and in the same way the three-dimensional quality of objects is expressed. The term drawing is sometimes limited to the representing of the forms of objects in outline, with or without the shading necessary to develop roundness or *modelling*. But the term has a wider significance. Any arrangement of colours or tones which serve to express form, and the relation of one form to another, is really drawing; and thus a painting may show fine draughtsmanship without line being used at all. Drawing is not a matter of the medium employed, but of the manner in which it is used. It is, however, convenient to classify drawings according to mediums, each of which produces its effect in a different way. Thus drawing may be divided into (1) pen drawing; (2) chalk, pencil, or charcoal drawing; (3) crayon and pastel drawing; (4) drawing shaded with the brush; (5) architectural or mechanical drawing. *Pen drawings* are often confined to pure outlines; an appearance of *relief* or projection being given by thickening or doubling the lines on the shadow side, or they may be shaded by combination of lines. *Chalk, pencil, and charcoal drawings* may be in line or tone. When the chalk is powdered and rubbed in with

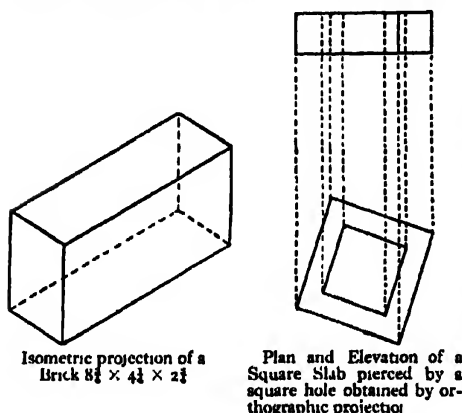
a stump, large masses and broad effects can be produced with much rapidity. The best draughtsmen, however, rarely use a stump. In *crayon and pastel drawings* the colours of the objects represented are more or less completely represented in the medium. *Drawings shaded with the brush* are outlined with the pencil or pen, the shading being laid on or *washed in* with the brush in tints of Indian ink, sepia, or colour. This was the method of the early water-colour painters in England. *Architectural and mechanical drawings* are those in which the proportions of a building, machine, &c., are accurately set out for the guidance of the constructor; objects are, in general, delineated by geometric or orthographic projection.

The great schools of painting all show excellent drawing, though differing in character. In Italy the Florentine school combined study of the antique with anatomical research, and produced many vigorous and expressive draughtsmen, notably Michael Angelo and Leonardo da Vinci. The Roman school, under the influence of Raphael, sacrificed vigour and expressiveness to elegance and the representation of ideal form. In the Lombard school a severe style of drawing is seen through harmonious colouring, and in the Venetian school the drawing is often veiled in the richness of the colour. The German and Dutch schools excel in a careful and minute style of naturalistic drawing, combined with good colour. The French school in the time of Poussin was very accurate in its drawing; at a later period its style betrayed a tendency to mannerism. David introduced, again, a purer taste in drawing and a close study of the antique, and these are qualities which distinguish his school (the so-called Classical school), of which Ingres is the leading representative, from the Romantic and Eclectic schools of a later period. The drawing of the British school is naturalistic rather than academic, but the work of Gainsborough and Alfred Stevens is comparable with that of earlier masters.—**BIBLIOGRAPHY:** Ruskin, *Elements of Drawing*; Spiers, *Architectural Drawing*; R. S. Bowers, *Drawing and Design for Craftsmen*; J. H. Brown, *Sketching without a Master*; Harold Speed, *Drawing*.

**Drawing-room**, a room appropriated for the reception of company; a room in which distinguished personages hold levees, or private persons receive parties. *Court drawing-rooms* are those assemblies held from time to time for the reception or presentation to the sovereign of such ladies as by custom, right, or courtesy are admissible. Receptions at which men are presented are known as *levees*. The sovereign sometimes deposes a member of the royal family to receive, in which case presentations are equivalent to those made to the sovereign in person.

**Drawings.** The term 'drawings' is usually taken to mean drawings of an architectural or engineering nature, such as the plans of a new building prepared by an architect, or the designs for engineering works, or for machinery produced by an engineer.

Three methods are commonly made use of in preparing drawings. (1) Orthographic, which represents the subject under consideration in one plane only, and from which dimensions may be scaled off, and which is the normal method of preparing an engineering drawing. (2) Perspective or radial projection is made use of by an architect for displaying the elevations of a building, and gives a truer appreciation of the actual appearance of the building than can be



obtained by orthographic projection. (3) Isometric projection enables one to show the length, breadth, and thickness of an object drawn to scale on the one drawing. Such a drawing is really composed of three sets of parallel straight lines, and is not strictly a true representation of the object as it would appear to the eye. It has the great advantage, however, that measurements may be directly scaled from it, and lines which are parallel in the object are also parallel in the drawing.

Drayton, Michael, an English poet, born in 1563, is said to have studied at Oxford, and afterwards held a commission in the army. The poem by which his name is chiefly remembered is his *Polyolbion* (1622, reprinted in 1890), a sort of topographical description of England. It is generally extremely accurate in its details, with, at the same time, many passages of true poetic fire and beauty. Other works are his *Lymphidia*, the *Court of Fairy*; *The Barons' Wars*; *The Legend of Great Cromwell*; *The Battle of Agincourt*; besides numerous legends, sonnets, and other pieces. He died in 1631, and was buried in Westminster Abbey.—Cf. O. Elton, *Michael Drayton: a Critical Study*.

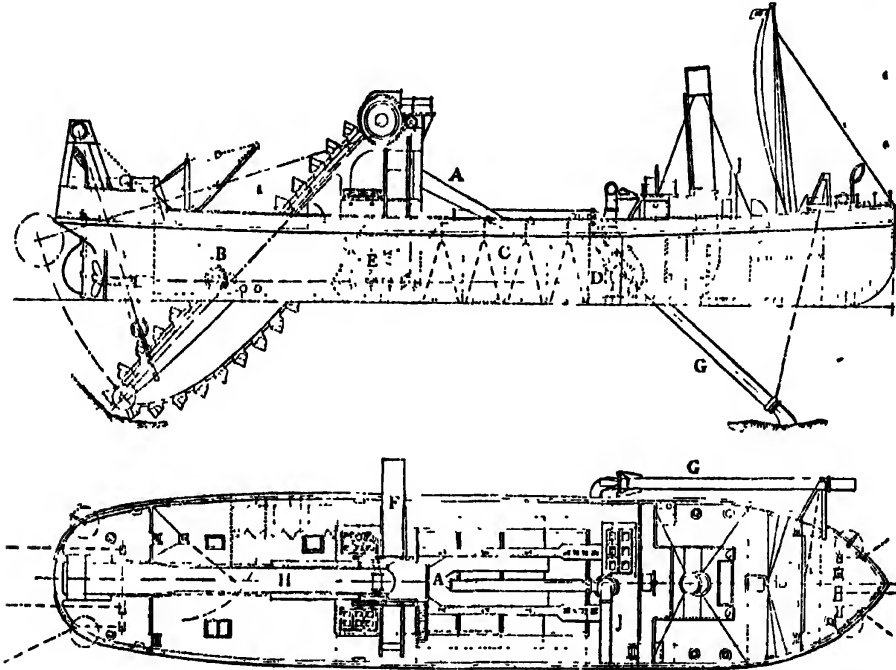
Drayton, Market, or Drayton-in-Hales, a town, England, county Salop, 18 miles north-east of Shrewsbury. It has a church, supposed to have been erected, with exception of the steeple, in the reign of William I. There are paper and half-cloth manufactories. Pop. 5187.

**Dreams**, trains of ideas which present themselves to the mind during sleep. The principal feature of the state of dreaming is the absence of conscious control over the current of thought, so that all kinds of fantastic notions, which in the waking state would at once be put aside, are woven into the texture of the dream. The usual content of dreams consists of aspirations or dreads, which the dreamer had recently entertained or experienced, mixed up with incidents which excited intense emotion at some earlier period of the individual's history, and especially in early childhood. The memory of unpleasant experiences, such, for example, as the horrors of trench warfare, which is repressed in the waking state, tends to force itself on the individual's attention when the conscious control is relaxed in sleep, and to give rise to disturbing dreams which may become so intense as to interfere with sleep and cause insomnia. The only rational remedy for this distressing trouble is to discover the painful incident and persuade the patient frankly to face it and not 'try to forget'. In recent years S. Freud has placed the study of dreams upon a scientific basis. He maintains that dreams represent the fulfilment of wishes. There is usually an utter want of coherency in the images that appear before the mental eye, but this excites no surprise in the dreamer. Occasionally, however, intellectual efforts are made during sleep which would be difficult to surpass in the waking state. It is said that Condillac often brought to a conclusion in his dreams reasonings on which he had been employed during the day; and that Franklin believed that he had been often instructed in his dreams concerning the issue of events which at that time occupied his mind. Coleridge composed from 200 to 300 lines during a dream: the beautiful fragment of *Kubla Khan*, which was all he was able to commit to paper when he awoke, remains a specimen of that dream-poem. Dreams are subjective phenomena dependent on natural causes. They are retrospective and resultant instead of being prospective or prophetic. The latter opinion has, however, prevailed in all ages and among all nations; and hence the common practice of divination or prophesying by dreams, that is, interpreting them as presages of coming events. Some authorities declare that all our dreams take place when we are in process of going to sleep or becoming awake, and that during deep sleep the mind is totally inactive. This is denied by the majority of philosophers,

and with apparent reason.—BIBLIOGRAPHY: Havlock Ellis, *The World of Dreams*; S. Freud, *The Interpretation of Dreams*; W. H. R. Rivers, *Instinct and the Unconscious*.

**Dredging**, a term applied to the operation of removing mud, silt, and other deposits from the bottom of harbours, canals, rivers, docks, &c. The most simple dredging apparatus is the spoon apparatus, which consists of a strong iron ring or hoop, properly formed for making an impression upon the soft matter at the bottom,

been converted, mainly by dredging, into a waterway carrying large vessels up to Glasgow. Dredging rivers for gold is now largely carried on; and the gold-dredge may even be floated in water artificially supplied. The operation of dragging the bottom of the sea for mollusca, plants, and other objects, usually for scientific observation, is also called dredging. The oyster-dredge is a light iron frame with a scraper like a narrow hoe on one side, and a bag attached to receive the oysters. The dredges used by



Plan and Elevation of an 800-ton Dredger

A, Shoot. B, Hoist-gear. C, Hopper. D, Sand-pump and its engines. E, Engines. F, Overboard shoot. G, Suction-pipe. H, Bucket-well. J, Overboard discharge.

so as to scoop it into a large leather bag attached to the ring and perforated with a number of small holes. The means for working it is a long handle, a suspending rope, and a crane or sweep-pole planted in a boat. Much more effective is the steam dredging-machine now in common use. It has a succession of strong iron buckets on an endless chain, which travels on a frame whose lower end is vertically adjustable so as to regulate the depth at which it works. It is worked by steam, and the buckets tear up the matter at the bottom, raise it, and discharge it into punts or hoppers close to the dredging vessel. Various forms of steam-pump dredgers, in which suction-pipes are the chief features, are also used. The River Clyde, from being a shallow stream, has

naturalists are mostly modifications of or somewhat similar to the oyster-dredge. Scientific dredging has of late assumed great importance as making us acquainted with the life of deep-sea areas.

**Dreissensia**, a genus of bivalve molluscs allied to the mussels. One species (*D. polymorpha*) is a native of the streams which flow into the Caspian, but has been accidentally introduced into most rivers and estuaries of Europe, including those of Britain, where it is now abundant.

**Dreincourt** (dré-laŋ-kör), Charles, a French Calvinistic minister, born at Sedan 1595, died at Paris 1609. He was the author of many controversial works, and of *Consolations against*

*the Fear of Death.* To promote the sale of the English translation of this work, De Poe wrote his *Apparition of Mrs. Veal.*

**Drenthe** (dren'te), a province of Holland, bounded by Hanover, Overijssel, Friesland, and Groningen; area, 948 sq. miles. It is in general more elevated than the surrounding provinces, especially in the centre. The soil is generally poor, and the surface largely consists of heath and morass, but the province is famed for its horses and cattle. Drenthe is remarkable for the great number of so-called 'giants' graves' or barrows scattered over the country. Its capital is Assen. Pop. 200,951.

**Dres'den**, the capital of the Republic (former kingdom) of Saxony, is situated in a beautiful valley on both sides of the River Elbe, which is here spanned by four stone bridges and an iron railway bridge. It is first mentioned in history in 1206, and has been the residence of the sovereigns since 1485; was greatly extended and embellished by Augustus the Strong (1694-1736), and rapidly increased during the nineteenth century. Among the chief sights are the museum (joined on to an older range of buildings called the Zwinger), a beautiful building containing a famous picture-gallery and other treasures; the Japanese palace (Augusteum), containing the royal library (founded by the Elector Augustus in the sixteenth century) of 570,000 volumes, besides a rich collection of manuscripts; the Johanneum, containing the collection of porcelain and the historical museum, a valuable collection of arms, armour, and domestic utensils, belonging to the Middle Ages. The palace, built about 1530, restored and remodelled externally between 1890 and 1902, and until 1918 the residence of the kings of Saxony, has also a fine interior, and contains (in what is called the Green Vault) a valuable collection of curiosities, jewels, trinkets, and works of art. The theatre is one of the finest structures of the kind in the world. The city is distinguished for its excellent educational, literary, and artistic institutions, among which are the Technical High School, much on the plan and scale of a university; the Conservatory and School of Music; and the Academy of Fine Arts. The manufactures are not unimportant, and are various in character; the china, however, for which the city is famed, is made chiefly at Meissen, 14 miles distant. The commerce is considerable, and has greatly increased since the development of the railway system. The chief glory of Dresden is the gallery of pictures, one of the finest in the world, which first became of importance under Augustus II, King of Poland and Elector of Saxony, but owes its most valuable treasures to Augustus III, who purchased the greater portion of the gallery

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of the Duke of Modena for £180,000. The pictures number about 3000, and in particular comprise many fine specimens of the Italian, Dutch, and Flemish schools. Besides this fine collection the museum contains also engravings and drawings amounting to upwards of 350,000. There is also a sculpture-gallery, the Albertinum, where by casts and otherwise the progress of sculpture is exemplified from the earliest times, all the most important antiques being shown. Dresden, being thus rich in treasures of art and favoured by a beautiful natural situation, is the summer resort of many foreigners. It suffered severely in the Thirty Years' War, and also in 1813, when it was the headquarters of Napoleon's army. It was occupied by the Prussians in 1806, but was evacuated in the following spring. Pop. 548,308.

**Dresden, Battle of**, a battle fought in 1813 (26-27th Aug.), between the French under Napo-



Dresden China. Candelabrum

leon and the Allies under Schwarzenberg. Napoleon had come to the relief of the city, which was occupied by the French. The Allies assaulted and bombarded the city, and soon after a great pitched battle was fought (27th Aug.), the Allies being defeated.

**Dresden China**, a delicate, semi-transparent, highly finished china made at Meissen, 14 miles from Dresden. The manufacture resulted from an accidental discovery made by Böttger, a young chemist, in 1710, and the vases, statuettes, groups of figures, candelabra, and clocks, manufactured during the eighteenth century are highly prized.

**Dreux** (dreu; Durocassis or Drocæ of the

Romans), a French town, department of Eure-et-Loir, on the Blaise, near to where it joins the Eure, 20 miles N.N.W. of Chartres. It is built at the foot of a hill crowned by a dilapidated castle, which contains a chapel, founded in 1142; to which has been added the costly mausoleum of the Orleans family. A battle took place near the town in 1562 between the Royalists under Montmorency and the Huguenots under Condé, in which the latter were defeated. Pop. 10,092.

Dreyfus, Alfred, captain of artillery and general staff-officer in the French army, was born of a Jewish family in Mulhouse, Alsace, in 1859. In Oct., 1894, he was arrested on a charge of communicating military documents to a foreign Government, supposed to be Germany; and at a secret court-martial, which sat in December, he was condemned to public degradation and lifelong imprisonment. Early in 1895 he was sent to the Île du Diable (Devil's Island), near Cayenne, to undergo his sentence. About the middle of the same year Colonel Picquart became head of the Intelligence Department, and in the course of his official duties discovered various circumstances tending to throw doubt on the correctness of the court-martial's decision, and pointing to another officer, of the name of Esterhazy, as the real traitor. Picquart was superseded by a Colonel Henry in Nov., 1897, and in the following January Esterhazy, charged by a brother of the condemned man with having written the *bordereau*, or memorandum, which was the chief document relied on by the prosecutors of Dreyfus, was acquitted by a court-martial. Two days later M. Zola, the eminent novelist, in a letter headed *J'accuse* published in the *Aurore*, made serious charges against the general staff and the Government in connection with the Esterhazy court-martial. He was prosecuted, and condemned to pay a heavy fine and undergo a term of imprisonment. In June, 1898, M. Brisson succeeded M. Méline as Prime Minister, and next month M. Cavaignac, his War Minister, read to the Chamber several documents which he regarded as conclusive proof of the guilt of Dreyfus. The chief of these was soon admitted by Colonel Henry to have been forged by him, and M. Cavaignac at once resigned. In June, 1899, the Cour de Cassation ordered a fresh court-martial. The court-martial, which sat at Rennes, found Dreyfus guilty with extenuating circumstances. He was sentenced to ten years' imprisonment, but was pardoned by President Loubet almost immediately. In 1906, when Clemenceau was Prime Minister, the sentence was annulled, and Dreyfus was reinstated in the army (as major). He was shot at by a reactionary journalist in 1908, but escaped without serious injury. In Sept., 1919, Lieutenant-Colonel Dreyfus was publicly presented with the

insignia of an officer of the Legion of Honour. Several times during the progress of the case France seemed on the verge of revolution.—Cf. J. Reinach, *Histoire de l'affaire Dreyfus*.

Driffeld, Great, a town, England, Yorkshire, at the head of a navigable canal communicating with the Humber at Hull. It lies in a fertile district, has an ancient parish church, and manufactures linseed-cake and manures. Pop. 5676.

Drift, in geology, a term applied to earth and rocks which have been conveyed by flood-action, glaciers, or floating ice and deposited over the surface of a country. It is sometimes used in a wider sense to denote all post-Pliocene sands, gravels, and clays, such as the superficial deposits shown on the 'drift' maps of the Geological Survey.

Drift, in mining, a horizontal tunnel or passage excavated underground that follows the course of a vein or stratum. Drift, in musketry, is the lateral deviation of the bullet after it has left the barrel of the rifle; it is due to the spin of the bullet and the resistance of the air.

Drift Sand, sand thrown up by the waves of the sea, and blown when dry some distance inland until arrested by obstacles, round which it gradually accumulates until the heaps attain considerable dimensions, often forming dunes or sand-hills. Coast-land sometimes requires artificial protection from encroachment by drift-sand.

Drill, a tool used for boring holes in wood, metal, stone, ivory, &c. It consists of a sharp spindle to which a circular motion is communicated by various contrivances. Drills are of various designs. For rock-boring the diamond rock-drill, an instrument with cutting edges made of bort or black diamond, is now generally adopted. See *Boring*.—Cf. Dana and Saunders, *Rock Drilling*.

Drill is the A B C of all military movements. In the Training Manuals of the British army the word is defined as "the training of the soldier to perform certain movements as a second nature". It follows, therefore, that drill is an essential part of the training of every soldier, more especially in the early days of his training, in that without it, and without the power of movement in obedience to the expressed will of a superior given by it, a body of soldiers would be merely a collection of armed men who, however willing individually, would be incapable of carrying out collectively an order given for the general good. In the early days of our history, when fighting was largely individual, and the whole duty of a soldier was 'to do unto the other fellow as he would do unto you—and do it first' (with a club), drill, as we know it, was unknown; each man armed himself as he thought fit, and, beyond getting into some formation for the

actual purpose of the assault, a battle was largely a go-as-you-please affair. In Saxon days the normal formation for the battle was the wedge; that is two men at the point followed by three, and so on till the available number was used up. This, of course, formed a solid pointed mass with considerable weight, and was used both for attack and defence. But once this formation was broken it was next to impossible to reform it. An instance of this weakness occurred at the battle of Hastings. The English were in this one and only wedge formation, officers and the better armed men at the point, and the less skilful and more indifferently armed at the base. Doubtless the troops had been got into this formation after much exertion in the way of pushing and vituperation, and, once in it, had been told on no account to break it. At a certain stage in the battle the heavily armoured Normans pretended flight; this was too much for the English, who broke their ranks and gave chase, each after his own particular source of ransom. This ended the battle; the Normans turned, and, owing to the entire inability of the English to re-form their ranks, the wedge, and with it the English army, ceased to exist: the result of want of discipline and absence of drill.

Drill and discipline are complementary to each other. In one of the battles of the Peninsular War, the 28th (now the Gloucestershire Regiment) were being hotly attacked in front by a French column. The regiment was firing in two ranks—the front rank kneeling and the rear rank standing—when suddenly a fresh attack developed from the rear. It was a matter of seconds for the commanding officer of the 28th to order the rear rank to turn about; drill and discipline did the rest, and the rear rank turned round, knelt down, and beat off the new attack. Since then the 28th has worn its badges both front and rear of its head-dresses.

Drill is an aid to discipline in that it teaches men that there is a right and a wrong way of doing a thing. Drill and the spirit arising from it has a great steadying effect on the nerves, as when in the European War the Guards Division, after being almost decimated during a German 'push', was brought out of the line and kept to steady drill for a week. To those who did not understand this appeared harsh and futile; to those who did it appeared, as it was, the best means of steadying men tried beyond endurance, and of preparing them for further efforts. Our English drill has passed through many phases in its time; but from the days when large bodies of men performed complicated manœuvres at the executive command of one man, through the times when drill, perhaps, was considered to be the be-all and end-all of the soldier, to modern days when it is recognized as a means

to an end, the guiding principle remains the same, viz. that one of the first essentials for a soldier is that he shall be so trained by drill that he shall know instinctively how to do the right thing at the right time and in the right way. Even now, when drill movements are no longer performed in face of an enemy, accuracy and attention to detail are insisted on in all parade-ground movements as part of the education of the soldier and as an aid to discipline. Drill for the soldier takes the place of the five-finger exercises for the musician. Neither of them, in itself, is of any particular value, but each adds to the efficiency of those who practise it.

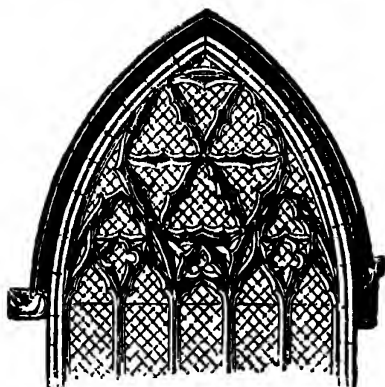
Drill (*Papio leucophaeus*), a large variety of baboon, smaller and less fierce than the mundrill, and like it a native of the coast of Guinea. The face and ears are bare and of a glossy black colour, the palms of the hands and soles of the feet are also naked and of a deep copper colour.

Drilling, the plan of sowing in parallel rows as distinguished from sowing broadcast. It was introduced into England by Jethro Tull, who invented the first implement for drilling, and published a work on the subject in 1731. The crops which are now generally drilled are turnips and flax. The first form of drill was of very simple construction, and was only adapted for potatoes, beans, peas, carrots, clover, cereals, sowing one row at a time, but now a great variety of improved implements is in use, some of which distribute artificial manure with the seed. Among the principal advantages of drilling over broadcast sowing we may mention that a considerable saving of seed is effected in the sowing of grain crops, but the great advantage is that in the case of green crops it enables the farmer more readily to clean the land both by the hand and by the horse-hoe. To keep the soil stirred and pulverized, which can only be properly done when the crops have been drilled, favours the retention and absorption of the moisture.

Dripstone, a projecting tablet or moulding over the head of a Gothic doorway, window, archway, or niche to throw off the rain. It is also called a *weather moulding*, and *label* when it is turned square. It is of various forms; sometimes a head is used as a termination or support, in others an ornament or simple moulding is adopted.

Driver, Rev. Samuel Rolles, D.D., professor of Hebrew and Biblical critic, born at Southampton 2nd Oct., 1846, died in 1914. He was educated at Winchester and at New College, Oxford, where he graduated with first-class honours in classics in 1869. In 1869 he gained the Pusey and Ellerton Hebrew Scholarship, and the Kennicott Scholarship (also for Hebrew) four years later, besides prizes for Septuagint Greek and Syriac. He was for some years a fellow and tutor

of his college, and from 1876 to 1884 a member of the Old Testament Revision Committee. In 1883, on the death of Dr. Pusey, he became Regius professor of Hebrew at Oxford and (*ipso facto*) a Canon of Christ Church. Of his numerous works we may mention: *A Treatise on the*



Dripstone over window, decorated Gothic, mixed tracery.  
Two different forms of termination.

*Use of the Tenses in Hebrew* (1874); *Isaiah: his Life and Times* (1888); *Introduction to the Literature of the Old Testament* (1891), a work suited for popular reading, which has passed through many editions; *Sermons on Subjects connected with the Old Testament* (1892); *The Parallel Psalter* (1904); *Commentaries* on various books of the Bible; and articles in *Bible Dictionaries* and in periodicals. He was a joint editor of the new *Hebrew-English Lexicon of the Old Testament* published by the Clarendon Press.

**Drogheda** (droh'e-da), an ancient town and seaport, formerly a parliamentary borough, Ireland, in the county of Louth, on both sides of the Boyne, about 4 miles from the sea, 26 miles north of Dublin. The Boyne is here crossed by a railway viaduct of 18 arches and 95 feet high. Flax and cotton-spinning are carried on; there are also salt-works, breweries, and tanneries; and the fisheries are increasing. There is a good export trade in cattle, sheep, grain, butter, and eggs. In 1412 a Parliament assembled here which enacted Poynings' Law. The town was for a long time strongly fortified, and was taken by Cromwell with great slaughter in 1649; it surrendered to William III immediately after the battle of the Boyne. Pop. 12,500.

**Drohobycz** (droh'o-bich), a Polish town in Galicia, formerly belonging to Austria, 41 miles s.s.w. of Lemberg. Its Catholic church is one of the handsomest in the country. It has an important trade, particularly in salt, obtained from springs in the vicinity. Pop. 40,000.

**Droit d'Aubaine** (drwâ-dô-bân), an old rule in some European countries, by which the prop-

erty of a foreigner who died was claimed by the State, unless the person had a special exemption. In France, where it was not abolished till 1819, the Scots, Savoyards, Swiss, and Portuguese were exempted.

**Droitwich** (droit'ich), a town of England, in the county and 6 miles N.N.E. of Worcester, on the Salwarp. It is famous for its brine springs, from which salt has been manufactured for more than 1000 years. Pop. 4146.

**Drôme**, a south-east department of France, covered almost throughout by ramifications of the Alps, the average height of which, however, does not exceed 4000 feet; area, 2508 sq. miles, of which about one-fourth is waste, one-third under wood, and a great part of the remainder under tillage and pasture. A considerable extent of the area is occupied by vineyards, and several of the wines produced have a high reputation, especially Hermitage. Olives, chestnuts, and silks are staple productions. Valence is the capital. Pop. 263,509.

**Dromedary**. See *Camel*.

**Dromore**, an episcopal city, Ireland, County Down, on the Lagan, here crossed by two bridges, 16 miles south-west of Belfast. Its cathedral



Common Water Drop-wort (*Eranthis fistulosa*)

a, Cluster of florets. b, Single floret.

contains the tomb of Jeremy Taylor. Pop. 2307.

**Dropsy** (Edema) is a condition usually marked by enlargement and swelling of the affected parts, and due to an accumulation of serous fluid in the tissue spaces and cavities of the body. Different names are given to such



accumulations in particular areas, thus *anasarca* refers to accumulations in the limbs and body generally; *ascites* to an accumulation of fluid in the peritoneal cavity (abdomen); *hydrothorax* to an accumulation in the pleural cavity (lungs); *hydrocephalus* to an accumulation in the brain. The commonest cause of dropsy is heart disease, where first the lower limbs, and then the trunk, are affected. It also appears in diseases of the kidneys and liver, and it may be produced in a limb by any obstruction of the veins of the part.

Drop-wort (from the small tubers on the fibrous roots), *Spirea filipendula*, nat. ord. Rosaceæ, a British plant of the same genus as queen-of-the-meadow, found in dry pastures. The hemlock drop-wort, or water drop-wort, is *Oenanthe fistulosa*.

*Drosera* cææ, a nat. ord. of polypetalous Dicotyledons, consisting of insectivorous marsh herbs, whose leaves are usually covered with glands or glandular hairs. It contains six genera, including the sundew (*Drosera*), and Venus's fly-trap (*Dionæa*). (See *Sundew* and *Dionæa*.) They have no known qualities except that they are slightly bitter. The leaves are generally circinate in the bud, as in ferns.

**Droshky**, a kind of light, four-wheeled carriage used by the Russians. It is not covered, and in



Russian Droshky

some types there is in the middle a sort of bench placed lengthways on which the passengers ride as on a saddle; but the name is now applied to various kinds of vehicles, as to the common cabs plying in the streets of German cities.

**Drouais** (drô-ä), Jean Germain, French historical painter of considerable repute, born at Paris in 1763, died at Rome 1788. His chief pictures are: *The Canaanitish Woman at the Feet of Jesus*, *Dying Gladiator*, and *Marius at Minturno*.

**Drouet** (dfo-ä), Jean Baptiste, Comte d'Erlon, French general, born 1765, died 1844. He served

in the campaigns of the Moselle, Meuse, and Sambre (1798-6), in the Peninsula, and at Waterloo, where he commanded the first *corps d'armée*. In 1834-5 he was Governor-General of Algeria, and in 1848 was made a marshal.

**Drouyn de Lhuys** (drô-an dé lwès), Édouard, French statesman and diplomatist, born 1805, died 1881. He entered the diplomatic service in 1831, and was chargé d'affaires at the Hague during the events which led to the separation of Belgium from Holland. In 1840 he was head of the commercial department under the Minister of Foreign Affairs. Opposition to Guizot caused his dismissal in 1845. He became Minister for Foreign Affairs in 1848, Ambassador to London in 1849; and again Foreign Minister in 1851, and in 1863. On the fall of the empire he fled to Jersey, but subsequently returned to France.

**Drowning** means death by the air being prevented from entering the lungs owing to the mouth, and nostrils being immersed in a liquid, the liquid being commonly water. Death may, therefore, occur by drowning in a small quantity of water. Thus a child may fall head downwards into a tub and be drowned, though the tub is not half full of water, sufficient to cover the mouth and nostrils being all that is necessary, and a man overcome by a fit or by drunkenness may fall on a road with his head in a ditch or pool of water, and thus meet death. Death is thus due to suffocation, to the stoppage of breathing, and to the entrance of water into the lungs. When death has been caused by drowning, the skin presents the appearance called goose-skin (*cutis anserina*), the face and surface of the body generally are usually pale, a frothy liquid is found in the lungs and air-passages, and about the lips and nostrils; water may be found in the stomach, and clenched fingers, holding substances grasped at, may serve to show that a struggle has taken place in the water, and that the body was alive at the time of immersion. Complete insensibility arises, it is probable, in from one or two minutes after submersion, recovery, however, being still possible, and death occurs in from two to five minutes. So long as the heart continues to beat, recovery is possible; after it has ceased it is impossible. Newly-born children and young puppies stand submersion longer than the more fully grown.

For the restoration of the apparently drowned several methods are suggested. Those of Dr. Silvester, recommended by the English Humane Society, and Dr. Benjamin Howard, of New York, will be described.

Whichever method is adopted, the following steps must first and immediately be taken: Pull the body up on to dry ground. Send immediately for medical assistance, warm blankets, dry clothing, brandy and hot water, if any one



is at hand to send. No delay must be permitted, however, in treating the drowned, so that if only one person is on the spot he must begin to treat the victim *instantly*, without seeking assistance. Remove all clothing from the neck and chest. Fold the articles of dress removed so as to make a firm pillow, which is to be placed under the shoulders, so that the upper part of the body is slightly raised and the head slightly thrown back. Cleanse the mouth and nostrils, open the mouth and pull forward the tongue. If natural efforts to breathe are made, try to stimulate them by



Fig. 1



Fig. 2

Howard's Method for restoring the apparently Drowned

brisk rubbing of the sides of the chest and of the face. If no effort to breathe is made, proceed to produce the entrance and outflow of air from the lungs by Silvester's or Howard's method.

**Silvester's method:** Stand or kneel behind the person's head, grasp each arm at the elbow, draw both arms simultaneously upwards till they are extended in line with the body, as a man places them when he stretches himself. Let this movement occupy about two seconds. This enlarges the chest and causes the entrance of air to the lungs. Without a pause carry the arms down to the sides, making them overlap the chest a little, and firmly press them on the chest. This movement should occupy other two seconds. It expels air from the lungs. Repeat the movements, and maintain them steadily and patiently at the rate of fifteen times a minute, until breathing has

been fully restored, or until medical aid arrives, or until death is certain. An hour is not too long a time to persist, and so long as there seems the least effort to breathe the movements must be persevered in.

**Howard's method:** Place the body on its face, with the roll of clothing under the stomach; the head being supported on the hand as shown in fig. 1. Pull the body over the roll of clothing to expel water from the chest. Then turn the body on the back, the shoulders being supported as shown in fig. 2. Kneel over the body. Place both hands on the lower part of the chest, so that the thumbs hook in under the lowest ribs and the fingers are spread out on the chest. Steadily press forwards, raising the ribs, your own body being thus thrown leaning forward. This enlarges the cavity of the chest and cruses air to enter. When the ribs have been raised to the utmost extent, with a slight effort push yourself back to the more erect position, allowing the ribs to recoil to their former position. This expels the air. Repeat the process fifteen times a minute. One person will find it more easy to maintain this method for a prolonged period than Silvester's, especially if the patient be big and heavy.

Meanwhile, if other persons are present they should be occupied rubbing the body and limbs (*always upwards*) with hands or warm flannel, applying hot flannels, bottles, &c., to the limbs, feet, arm-pits, &c. As soon as the person is sufficiently restored to be able to swallow, give small quantities of hot brandy and water, hot wine and water, hot coffee, &c., and use every effort to restore and maintain warmth.

Drowning was formerly a mode of capital punishment in Europe. The last person executed by drowning in Scotland suffered death in 1685. It survived in Switzerland until 1652, and in Austria until 1776. In Russia the punishment was abolished early in the eighteenth century.

**Droylsden**, a town of England, Lancashire,  $3\frac{1}{2}$  miles E. of Manchester, of which it is practically a suburb. Pop. 13,250.

**Droz** (drô), François Xavier Joseph, French moralist and historian, born at Besançon 1773, died 1850. In 1800 he published an *Essai sur l'Art d'être Heureux*, which was very popular; and in 1823 *De la Philosophie Morale, ou des Différents Systèmes sur la Science de la Vie*, which procured his admission into the Academy. His reputation is, however, founded chiefly on his *Histoire du Règne de Louis XVI.*

**Drugget**, a coarse kind of woollen felt or cloth, formerly used by the lower classes for purposes of clothing, but now chiefly used as a covering for carpets.

**Druids**, the priests of the Celts of Gaul and

Britain. According to Julius Cæsar they possessed the greatest authority among the Celtic nations. They had some knowledge of geometry, natural philosophy, &c., superintended the affairs of religion and morality, and performed the office of judges. They were also well versed in the knowledge of the mysterious powers of plants and animals, and were adepts in the magic arts. They venerated the mistletoe when growing on the oak, a tree which they likewise esteemed sacred. They had a common superior, who was elected by a majority of votes from their own number, and who was appointed for life. They took unusual care to fenge themselves round with mysteries, and it is probable that they cherished doctrines unknown to the common people; but that they had a great secret philosophy which was handed down by oral tradition is very unlikely. Of their religious doctrines little is known.—BIBLIOGRAPHY: J. Rhys, *Lectures on the Origin and Growth of Religion as Illustrated by Celtic Heathenism*; D'Arbois de Jubainville, *Les Druides et les dieux celtiques à forme d'animaux*.

**Druids, Order of**, a secret organization, founded in London in 1781, for the purpose of mutual aid and protection. Their rites somewhat resemble those of freemasons; their lodges are known as 'groves'.

**Drum**, a musical instrument of percussion, of Eastern origin, either cylindrical or hemispherical in shape, with the end or ends covered with tightened parchment, which is stretched or slackened at pleasure by means of cords with sliding knots or screws. Drums are of three kinds: (1) the long or bass drum, played with stuffed-nob drumsticks, and used only in large orchestras or military bands; (2) the side-drum, having two heads, the upper one only being played upon by two sticks of wood; (3) the kettle-drum, a hemisphere of brass or copper, the end of which is covered with parchment, always used in pairs, one drum being tuned to the key-note, and the other to the fifth of the key, the compass of the two together being an octave. The use of drums was introduced into Europe either by the Moors or the Crusaders.

**Drumclog'**, a moorland tract in Lanarkshire, Scotland, 6 miles s.w. of Strathaven, the scene of a skirmish between Claverhouse and the Covenanters, in which the former was defeated (1679). A graphic description of the battle is given by Scott in his *Old Mortality*.

**Drum-fish**, or **Drum**, *Pogonias chromis*, and other species of the same genus, fishes found on the Atlantic coast of N. America, and so named from the deep drumming sound they make, by means of the swim-bladder and its muscles, during the spawning season in April. It is the most powerful sound-producing apparatus

known among fishes. They often weigh about 20 lb.

**Drum-major**, in the British army, a warrant or non-commissioned officer whose duty it is to teach and direct the drummers. He marches at the head of the band carrying the regimental baton.

**Drum'mond**, Professor Henry, was born at Stirling in 1851, died in 1897. Educated at the Universities of Edinburgh and Tübingen, he entered the ministry of the Free Church, and having devoted much attention to science, in 1877 was appointed lecturer on natural science in the Free Church College (or divinity hall), Glasgow, becoming professor in 1884. He travelled much, and wrote a popular book on *Tropical Africa* (1888). His most remarkable work is *Natural Law in the Spiritual World* (1888), which has passed through many editions and been translated into various languages. He is author, also, of *Travel Sketches in Our New Protectorate*, *The Greatest Thing in the World*, and *The Ascent of Man* (1894).

**Drummond**, Rev. James, Unitarian theologian, was born at Dublin in 1835, died 18th June, 1918. After receiving his early education at a private school, he entered Trinity College, Dublin, where he graduated and obtained the first gold medal for classics in 1855. In 1859 he became colleague of the Rev. W. Gaskell in Cross Street Chapel, Manchester, and ten years later was appointed professor of theology at Manchester New College, London, of which institution (now known, since its removal to Oxford in 1889, simply as Manchester College) he was principal from 1885 to 1906, when he retired from his post. His works include: *Spiritual Religion: Sermons on Christian Faith and Life* (1870); *The Jewish Messiah: a Critical History of the Messianic Idea among the Jews* (1877); *Introduction to the Study of Theology* (1884); *Philo-Judeus* (2 vols., 1888); *Via, Veritas, Vita* (the Hibbert lectures for 1894); *The Pauline Benediction* (1897); *The Epistles to the Thessalonians, &c.* (International Handbooks, 1899); *Some Thoughts on Christology* (1902); *The Character and Authorship of the Fourth Gospel* (1904); *Johannine Thoughts* (1909); *Paul: his Life and Teaching* (1911).

**Drummond**, William, of Hawthornden, a Scottish poet distinguished for the elegance and tenderness of his verses, was born at Hawthornden House, 7 miles from Edinburgh, 1585, died 1649. He was educated at the University of Edinburgh; after which he spent four years in foreign travels, residing for a part of the time at Bourges, to study the civil law. On his return to Scotland he retired to Hawthornden and gave himself up to the cultivation of poetry and polite literature, and here he spent the most of his

life. He entertained Ben Jonson on the occasion of a visit which the English dramatist made to Scotland in the winter of 1618-9, and took notes of Jonson's conversation, first published in entirety in 1842 (*Notes of Ben Jonson's Conversations with William Drummond*). He was the first Scottish writer to abandon the native dialect for the language raised to supremacy by the Elizabethan writers. His chief productions are: *The Cypress Grove*, in prose, containing reflections upon death; *Flowers of Zion, or Spiritual Poems*; *Tears on the Death of Mæliades* (that is, Prince Henry); *Poems, Amorous, Funeral, Divine, Pastoral, in Sonnets, Songs, Sestains, Madrigals*; *The River Forth Feasting* (on King James's visit to Scotland in 1617); *Polemo-Middinia, or the Battle of the Dunghill: a Macaronic Poem*; and *History of the Lives and Reigns of the Five Jameses, Kings of Scotland*. As an historian he is chiefly remarkable for an ornate style, and a strong attachment to the High Church principles of the Jacobites.

Drumont, Édouard, French journalist and anti-Semite agitator, born at Paris in 1844, died there in 1917. His work *Mon vieux Paris* (1879) was crowned by the Académie Française. In 1886 he published *La France Juive devant l'opinion*. He thus began a violent campaign against the Jews which he continued until his death, especially in his organ *La Libre Parole*, founded in 1892. In 1898 he was elected to the Chamber of Deputies, retaining his seat till 1902. His other works include: *La fin d'un monde* (1888), *Testament d'un Anti-Sémite* (1891), *De l'or et de la boue du Sang* (1896), and *Les Juifs et l'affaire Dreyfus* (1899).

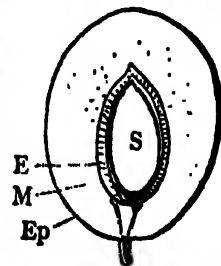
**Drunkards, Habitual.** The Habitual Drunkards Act of 1879 provided for the licensing of retreats for receiving habitual drunkards, and for the regular inspection of such retreats. An habitual drunkard desiring admission to a retreat had to make a written application, accompanied by a declaration of two persons that the applicant was an habitual drunkard, and attested by two justices of the peace. No patient in a retreat was permitted to leave before the expiration of the term stated in the application, such term not to exceed one year. This Act was to expire in ten years; but another Act, passed in 1888, made it permanent, with some modifications. The Inebriates Act of 1898 introduced several important changes. It transferred the licensing power in counties from justices of the peace to County Councils and their committees, and in boroughs from magistrates to town councillors or police commissioners. The maximum period of detention was extended to two years, and the attestation of one justice was made sufficient for a valid application. It also gave power to the Secretary of State to establish State

inebriate reformatory, or to grant certificates to reformatory suitable for such a purpose. If an habitual drunkard, when drunk, commit an offence punishable by imprisonment or penal servitude, the court may, in addition to, or in substitution for, the ordinary sentence, order him to be detained three years in a State or certified inebriate reformatory. The proof that the accused is an habitual drunkard may consist either in his own admission or in the jury's verdict after inquiry. The Inebriates' Act of 1899 was very short, and made no important change in the law. In Scotland habitual drunkenness is now a ground justifying judicial separation of spouses, while under the Matrimonial Causes Bill, 1920, it is proposed that in England, where one spouse has been granted a temporary separation order on the ground of the incurable habitual drunkenness of the other, and such order has been in force for at least three years, a divorce should be granted.

**Drunkennes,** the state of being drunk or overpowered by alcoholic liquor, or the habit of indulging in intoxication. A similar condition may be produced by numerous agents, but the term is always applied to the act or habit of drinking alcoholics to excess. By the law of Britain drunkenness is an offence against the public economy, and those found drunk are liable to fine or imprisonment. Drunkenness is no excuse for any crime, but it renders a contract invalid if either of the parties was in a state of complete drunkenness when the contract was signed.

**Drunken Parliament,** in Scottish history, a name given to the Privy Council who, under their powers as representing the estates between sessions, met at Glasgow and passed an Act (1st Oct., 1662) to remove the recusant ministers from their parishes within a month. All the members were said to have been drunk except Lockhart of Lee, who opposed the measure.

**Drupe,** in botany, a stone fruit; a fruit in which the outer part of the pericarp becomes fleshy or softens like a berry while the inner hardens like a nut, forming a stone with a kernel, as the plum, cherry, apricot, and peach. The stone enclosing the kernel is called the *endocarp*, while the pulpy or succulent part is called the *mesocarp*. In some fruits, as those of the almond, the horse-chestnut, and coco-nut,



Longitudinal Section of Plum

S, Seed. E, Endocarp, or shell. M, Mesocarp, or intermediate layer. Ep, Epicarp, or skin.

the mesocarp is not succulent, yet, from their possessing the other qualities of the drupe, they receive the name. See *Berry*.

**Drury Lane Theatre**, one of the principal theatres in London, was established by Thomas Killigrew in the reign of James I. In 1671 it was burned down, and was rebuilt by Sir Christopher Wren between 1672 and 1674, but again destroyed by fire in 1609. On this occasion it was rebuilt by B. Wyatt, and was reopened on 10th Oct., 1812, with an address composed by Lord Byron. It was in connection with this opening that James and Horace Smith wrote the *Rejected Addresses*. Nearly all the great English actors from Betterton and Garrick have been more or less connected with Drury Lane.—*Cf. J. Doran, In and About Drury Lane.*

**Druses**, a curious people of mixed Syrian and Arabian origin, inhabiting the mountains of Lebanon and Anti-Lebanon, and also the Hauran (south-west of Damascus). In their faith are combined certain Jewish, Christian, and Mohammedan doctrines. They describe themselves as followers of Khalif Hakim Bi-amr-Allah, whom they regard as an incarnation of deity, the last prophet, and the founder of the true religion. They are nearly all taught to read and write. They maintain a semi-independence, and between 1840 and 1860 they engaged in bloody conflicts with their neighbours the Maronites. Their total number is estimated at 100,000. They are very friendly to the English, and some of them have been converted to Christianity. *Cf. E. Sell, The Druses.*

**Drusus**, the name of several distinguished Romans, among whom were: *Marcus Livius*, orator and politician; became tribune of the people in 122 B.C. He opposed the policy of Gaius Gracchus, and became popular by planting colonies.—*Marcus Livius*, son of the above, was early a strong champion of the senate or aristocratic party, but showed great skill in manipulating the mob. He rose to be tribune of the people, and was assassinated 91 B.C.—*Nero Claudius*, brother of the Emperor Tiberius, born 38 B.C. By a series of brilliant campaigns he extended the Roman Empire to the German Ocean and the River Elbe, and was hence called *Germanicus*. By his wife Antonia, daughter of Mark Antony, he had a daughter, Livia, and two sons, Germanicus and Claudius, the latter of whom afterwards became emperor. He died in 9 B.C.

**Dry'ads**, wood nymphs, in the Greek mythology; supposed to be the tutelar deities of trees. Each particular tree or wood was the habitation of its own special dryad.

**Dryas**. See *Mountain Avens*.

**Dryburgh Abbey**, a monastic ruin in Scotland, consisting of the nave's western gable, the

gable of the south transept, and a fragment of choir and north transept of an abbey founded in 1150 on the banks of the Tweed, about 5 miles E.S.E. of Melrose. It is celebrated as the burial-place of Sir Walter Scott and his family.

**Dry Cell**, originally a cell of the Leclanché type, in which the solution of sal-ammoniac was replaced by a paste containing this substance. The formulæ or recipes from which dry cells are now made up are numerous, although the electrodes, as a rule, remain the same as in the Leclanché cell. The E.M.F. of the cell is about 1.5 volts, and three dry cells are used to light up a small 'flash' lamp. A battery of dry cells forms a convenient and portable means of supplying a small current at voltages up to 100.

**Dryden**, John, English poet, was descended from an ancient family, his grandfather being Sir Erasmus Dryden of Canons Ashby, Northamptonshire. Born near Aldwinkle, Northamptonshire, in 1631, he was admitted a King's scholar at Westminster under the celebrated Dr. Busby, whence he went to Trinity College, Cambridge, being elected to a scholarship there. After leaving the university, he went to London, where he acted as secretary to his cousin Sir Gilbert Pickering, a favourite of Cromwell; and on the death of the Protector he wrote his *Heroic Stanzas* on that event. At the Restoration, however, he hailed the return of Charles II in *Astræa Redux*, and from that time his devotion to the Stuarts knew no decay. In 1661 he produced his first play, *The Duke of Guise*; but the first that was performed was *The Wild Gallant*, which appeared in 1663 and was not a success. This was followed by *The Rival Ladies*, and *The Indian Queen*, a tragedy on Montezuma in heroic verse, written in collaboration with Sir Robert Howard, whose sister, Lady Elizabeth Howard, Dryden married in 1663. He followed up *The Indian Queen* with *The Indian Emperor*, which at once raised Dryden to the highest pitch of public estimation, an elevation which he retained till his death. The great fire of London put a stop for some time to theatrical exhibitions. In the interval Dryden published the *Annus Mirabilis*, an historical account of the events of the year 1666, one of the most elaborate of his productions. In 1668 he also published his celebrated *Essay on Dramatic Poesy*—the first attempt to regulate dramatic writing. In 1668 *The Maiden Queen*, a tragi-comedy, was represented. This was followed in 1670 by *The Tempest*, an alteration from Shakespeare, in which he was assisted by Sir William Davenant. It was received with general applause, notwithstanding the very questionable taste and propriety of the added characters. Dryden was shortly afterwards appointed to the office of Historiographer Royal and Poet Laureate, with a salary of £200 a year. He now

became professionally a writer for the stage, and produced many pieces, some of which have been strongly censured for their licentiousness and want of good taste. The first of his political and poetical satires, *Absalom and Achitophel* (Monmouth and Shaftesbury), was produced in 1681, and was followed by *The Medal*, a satire against sedition; and *Mac Flecknoe*, a satire on the poet Shadwell. In 1682 he published a poem called *Religio Laici*, wherein he maintained the doctrines of the Church of England. On the accession of James in 1685 Dryden became a Roman Catholic, a conversion the sincerity of which has been not unreasonably regarded with suspicion, considering the time at which it occurred. At court the new convert was received with open arms, a considerable addition was made to his pension, and he defended his new religion at the expense of the old one in a poem, *The Hind and the Panther*. Among his other services to the new king were a savage reply to an attack by Stillingfleet, and panegyrics on Charles and James under the title of *Britannia Rediviva*. At the Revolution Dryden was deprived of the offices of Poet Laureate and Historiographer, and of the certain income which these offices secured him. During the remaining ten years of his life he produced some of his best work, including his admirable translations from the classics. He published, in conjunction with Congreve, Creech, and others, a translation of Juvenal, and one of Persius entirely by himself. About a third part of Juvenal was translated by Dryden, who wrote an essay on satire which was prefixed to the whole. His poetic translation of Virgil appeared in 1697, and, soon after, the well-known lyric *Alexander's Feast*, and his *Fables*. He died 1st May, 1700, in the sixty-ninth year of his age, and was buried in Westminster Abbey. Dryden is unequalled as a satirist among English poets, and the best of his tragedies are unsurpassed by any since written. His poetry as a whole is more remarkable for vigour and energy than beauty, but he did much to improve English verse. He was also an admirable prose writer. Personally he was modest and kindly. The whole of his works, edited by Sir W. Scott, were published in 1818 (18 vols. 8vo); they were republished with additional notes, &c., by Professor Saintsbury (1882-93).—BIBLIOGRAPHY: R. Garnett, *Age of Dryden*; Sir A. W. Ward, *History of English Dramatic Literature*; *Cambridge History of English Literature* (vol. viii).

**Drying-machine**, a machine consisting of any number of steam-heated cylinders up to thirty or even more, each about 22 inches in diameter, and used in bleachworks, dye-houses, and in cloth-finishing departments; used as a separate machine to dry fabrics which contain

a certain amount of moisture left in at some previous operation, but often used in conjunction with a starching-mangle or similar apparatus. All the cylinders are in a horizontal plane, and usually in two rows, but such rows may be disposed either in horizontal or vertical frames. Floor-space is economized in the latter arrangement, and two or more groups of two rows per group may be provided for. Each cylinder is provided with some type of safety air-valve, which yields to allow air to enter in proportion as the steam is condensed in the cylinder, and so prevents the latter from collapsing. The condensed steam is withdrawn, either by means of siphons or revolving scops, so that the interior may be as dry as possible. The long length of cloth, either from the squeezing-rollers of the starch-mangle or from a loose or rolled state of cloth from some other machine, is conducted over guide-rollers, then under and over the two rows of steam-heated cylinders, and finally led from the last cylinder to the roller of a plaiting-down apparatus, or otherwise delivered. Both sides of the cloth thus come into direct contact with half the number of cylinders as it is drawn through the machine, and the dried cloth is ultimately delivered by the plaiting-down apparatus in folds ready for the subsequent operations.

**Drying-oils**, linseed and other oils, which are the bases of many paints and varnishes. When exposed to the air, they absorb oxygen, and are converted into a transparent, tough, dry mass or varnish.

**Dry-point**, a method of engraving generally regarded as part of etching, but more closely allied to line engraving. Instead of the copper being covered with etching ground and the lines bitten with acid, a pointed instrument is drawn across it, which incises a fine line with a more distinct burr on each side than that raised by a graver. This burr helps to give a characteristic quality to the line, but is rapidly worn away by printings. Dry-point may be used by itself, but is frequently combined with etching proper.

**Dry-rot**, a well-known disease affecting timber, occasioned by various species of Fungi, the mycelium of which penetrates the timber, destroying it. *Merulius lacrymans*, which is found chiefly in fir-wood, is the most common and most formidable dry-rot fungus in Britain; while



Dry-rot Fungus (*Merulius lacrymans*)

*Polyporus destructor* is equally destructive in Germany. *P. vaporarius* may also cause dry-rot. Damp, unventilated situations are most favourable to the development of dry-rot Fungi.

Various methods have been proposed for the prevention of dry-rot; that most in favour is thoroughly saturating the wood with creosote, which makes the wood unfit for vegetation, but proper ventilation is the surest safeguard.

**Dual**, in grammar, that number which is used, in some languages, to designate two things, whilst another number (the plural) exists to express many. The Greek, Sanskrit, and Gothic among ancient languages, and the Lithuanian and Arabic among modern, possess forms of the verb and noun in which two persons or things are denoted, called the *dual* numbers.

**Du'alism**, the philosophical exposition of the nature of things by the hypothesis of two dissimilar primitive principles not derived from each other. Dualism in religion is chiefly confined to the adoption of a belief in two fundamental beings, a good and an evil one, as is done in some Oriental religions, especially that of Zoroaster. In metaphysics, dualism is the doctrine of those who maintain the existence of matter and form, or mind and matter, as distinct substances, in opposition to idealism, which maintains that we have no knowledge or assurance of the existence of anything but our own ideas or sensations. Dualism may correspond with realism in maintaining that our ideas of things are true transcripts of the originals, or rather of the qualities inherent in them, the spirit acting as a mirror and reflecting their true images; or it may hold that, although produced by outward objects, we have no assurance that in reality these at all correspond to our ideas of them, or even that they produce the same idea in two different minds. Among modern philosophers Professor W. McDougall and Bergson have defended the doctrine of dualism. See *Monism*.—**BIBLIOGRAPHY**: J. Ward, *The Realm of Ends*; W. James, *Essays in Radical Empiricism*; H. Bergson, *Matter and Memory*.

**Dubail**, Augustin Edmond, French general, born at Belfort 15th April, 1851. He served in the Franco-Prussian War, and was for many years colonel of a Zouave regiment in Algeria. Chief of the Staff of the French army in 1914, he commanded the First Army operating in Alsace-Lorraine, and successfully defended Nancy. Appointed Military Governor of Paris in 1915, he held this post until June, 1918.

**Du Barry**, Marie Jeanne Bécu, Comtesse, mistress of Louis XV, was born at Vaucouleurs in 1748. She came young to Paris, and was presented to the king in 1769, who had her married for form's sake to the Comte du Barry. She exercised a powerful influence at court, and with some of her confidants completely ruled the king. Important offices and privileges were in her gift, and the courtiers abased themselves before her. After the death of Louis she was

dismissed from court and sent to live in a convent near Meaux. She received a pension from Louis XVI. During the reign of terror she was arrested as a Royalist and executed, Nov., 1793.—*Cf.* N. Williams, *Madame du Barry*.

**Dubit'za**, a fortified town of Bosnia, in Yugoslavia, on the right bank of the Unna, about 10 miles from its confluence with the Save. In the sixteenth and seventeenth centuries it was a frequent point of contention between Austria and Turkey. In 1878, with the rest of Bosnia, it passed under Austrian administration. Pop. 3260.—*Dubitzza*, in Croatia, on the opposite bank of the Unna, has 6660 inhabitants.

**Dub'lin**, the metropolis of Ireland, is situated in County Dublin, on the east coast of the island, at the mouth of the Liffey, the banks of which for more than 2 miles from the sea are lined with quays. The river, which divides the city into two unequal parts, is crossed by numerous bridges. In the old part of the city the streets are irregular, narrow, and filthy; in the more modern and aristocratic quarters there are fine streets, squares, and terraces, but with little pretension to architectural merit. The public buildings, however, are especially numerous and handsome. The main thoroughfare, east to west, is by the magnificent quays along the Liffey. The principal street at right angles to the river is Sackville Street, a splendid street 650 yards long and 40 yards wide, forming a thoroughfare which is continued across the river by O'Connell Bridge, a magnificent structure the same width as Sackville Street. The principal public secular buildings are the castle, the official residence of the viceroy; the Bank of Ireland, formerly the Irish Parliament House; Trinity College; the custom-house, destroyed in 1921; the King's Inns; the post office; rotunda; corn exchange; commercial buildings; the mansion house; and the city hall or corporation buildings. The most important literary and scientific institutions are Trinity College (Dublin University); the National University of Ireland; the Royal College of Science; the Catholic University; the College of Surgeons; the Royal Dublin Society; the Royal Hibernian Academy of Painting, Sculpture, and Architecture; the Royal Irish Academy for Promoting the Study of Science, Literature, and Antiquities; the Archaeological Society; and the Royal Zoological Society. Dublin contains two Protestant Episcopal cathedrals—St. Patrick's Cathedral, erected in 1190, and thoroughly restored between 1860 and 1865, through the munificence of Sir Benjamin Lee Guinness; and Christ's Church, built in 1038 and restored between 1870 and 1877, the restoration being carried out at the expense of Henry Roe. The Roman Catholic Cathedral is a very large edifice. The charitable institutions are numerous, and some



of them possess splendid buildings. There are several extensive military and constabulary barracks in the city and vicinity. A little north-west of the city, up the Liffey, is the Phoenix Park, with an area of 1759 acres. In it are the Viceregal Lodge, the usual residence of the King's representative; the Chief Secretary's and Under-Secretary's official residences; the Royal Hibernian Military School; and the depot of the Royal Irish Constabulary; as also the gardens of the Royal Zoological Society. The manufactures carried on are of little note: poplins, for which Dublin has been long celebrated, are still in some request, and brewing and distilling are largely carried on. Since 1918 Dublin returns seven members to the House of Commons. The Sinn Féin members, however, elected in 1918, never attended the Imperial Parliament. Serious risings occurred in Dublin at Easter 1916, in 1910, and 1920, and there were also disorders in May 1921. Dublin is an ancient town, but its early history is obscure. It was held by the Danes for more than three centuries from 836. Pop. 399,000 (1919).—The county, which is in the province of Leinster, on the east coast of the island, has an area of 218,873 acres, about a third of it under crops of various kinds, chiefly grass and clover. The surface on the whole is flat, but the ground rises at its southern boundary into a range of hills, the highest of which—Kippure—is 2473 feet above the sea. There is about 70 miles of sea-coast, the chief indentation being Dublin Bay. The principal stream is the Liffey, which intersects the county west to east. Important water communications are the Royal and the Grand Canals, both centering in Dublin, and uniting the Liffey with the Shannon. The manufactures are unimportant, but the fisheries are extensive. Since 1918 the county returns four members to the House of Commons. Pop. 172,304; Dublin (county borough), 304,802.—Cf. D. A. Chart, *The Story of Dublin*.

Dublin, University of, an institution founded in 1501, when a charter, or letters-patent, was granted by Queen Elizabeth for the incorporation of the "College of the Holy and Undivided Trinity", the University and Trinity College being practically the same. The corporation now consists of a provost, seven senior fellows, twenty-six junior fellows, and seventy foundation scholars. The Senate of the university consists of "the chancellor of the university, or in his absence, of the vice-chancellor, and such doctors or masters of the university as shall have and keep their names on the books of Trinity College". The Senate possesses the right of electing the chancellor of the university; it is also the body which grants degrees. The fellows are appointed for life, after an examination. The

scholars are chosen from among the undergraduates, after an examination in mathematics and logic, or in Greek, Latin, and logic. The scholarships are tenable for five years, or till the degree of M.A. is attained. The course of general instruction extends over four years. The academical year is divided into three terms—Michaelmas, Hilary, and Trinity—and every student must keep at least two terms in each year in order to obtain a degree. The system of instruction is superintended by the fellows, both junior and senior, together with a large staff of professors in the various departments of science and literature. Eighteen of the junior fellows act as tutors, and every student must place himself under one of these on entering the college. The B.A. degree is given after examination in the usual subjects, and may be a pass or honours degree; the M.A., as at Oxford and Cambridge, is gained by the payment of a fee after a certain time has elapsed. There are also a law school, a medical school, and a school of engineering, and degrees are granted in these subjects, as well as in arts and divinity. The college possesses a library of about 285,000 printed volumes and 1700 manuscripts. It has also a botanic garden and museum. In 1613 James I granted to the university the right of returning two members to Parliament. One was taken away at the Union, but was restored by the Reform Bill of 1832. The number of students in 1920 was 1350.—Cf. *Dublin University Calendar*.

Dubno, a town of the Ukraine, government of Volhynia. It was a place of some importance before the annexation of Western Poland by Russia. During the European War it was recaptured in the Russian advance in June, 1916. Pop. 14,000.

Dubois (du-bwä), Guillaume, a French cardinal, was the son of an apothecary, born in 1656, died 1723. He became tutor to the Duke of Chartres, afterwards Duke of Orleans and Regent, and maintained his influence by pandering to the vices of his pupil. He became Privy Councillor and overseer of the duke's household, and Minister for Foreign Affairs under the regency. The archbishopric of Cambrai having become vacant, Dubois ventured to request it of the regent, although he was not even a priest. The regent was astonished at his boldness; but he obtained the post, having in one morning received all the clerical orders, and, a few days after, the archbishopric. By his consummate address he obtained a cardinal's hat, and in 1721 was appointed Prime Minister. Dubois was an avaricious, lying, licentious creature, yet clever and industrious, and able to make himself very agreeable where it suited his interest.

Dubois (du-bwä), Paul, French sculptor, born 1829, died in 1905. He first studied law, but



from 1856 to 1858 gave himself up to sculpture under Toussaint at Paris, and then went to Italy, where the sculptors of the early Renaissance, Donatello and Luca Della Robbia, had a decided influence upon him. Among his works are a *St. John*, a *Narcissus*, a *Madonna and Child*, *Eve Awakening to Life*, a figure of *Song* for the opera-house at Paris, and numerous busts; but his greatest work is the monument of General Lamoricière in the Cathedral of Nantes, with figures of *Military Courage*, *Charity*, *Faith*, and *Meditation*, which rank among the best products of French plastic art. He is also distinguished as a painter of portraits. He was director of the École des Beaux Arts from 1878 until his death, and received the grand cross of the Legion of Honour.

Du Bois-Reymond (dù bwā-rā-mōn), Emil, German physiologist, and an especial authority on animal electricity, born at Berlin 1818, died in 1896. He studied theology, geology, and afterwards anatomy and physiology, and became professor of physiology in the University of Berlin in 1858. His principal publication is *Researches in Animal Electricity*.

Dubov'ka, a town of South Russia, government of Saratov, on the Volga; it has an extensive river trade in wool, iron, oil, and grain. Pop. 16,530.

Dubuque (du-būk'), a city of Iowa, United States, on the right bank of the Mississippi. It occupies an important commercial position as a railway centre and entrepôt for the agricultural and mineral products of the northern half of Iowa, and the timber of Wisconsin, and also from the valuable lead-mines in its vicinity. Pop. 39,428.

Ducange (dù-kānz), Charles Dufresne, Sieur, a French historian and linguist, was born in 1810 near Amiens, died at Paris 1688. He studied in the Jesuits' College at Amiens, afterwards at Orleans and Paris. At this last place he became Parliamentary Advocate in 1681, and in 1645 Royal Treasurer at Amiens, from which place he was driven by a pestilence, in 1668, to Paris. Here he devoted himself entirely to literature, and published his great works, viz. his *Glossaries of the Greek and Latin peculiar to the Middle Ages and the Moderns*, his *Historia Byzantina*, the *Annals of Zonaras*, the *Numismatics of the Middle Ages*, and other important works.

Ducas, Michael, Byzantine historian, flourished in the fifteenth century. His *Historia Byzantina*, which contains a reliable account of the siege and sack of Constantinople, was largely used by Gibbon.

Duc'at (Lat. *ducdus*, a duchy), a coin formerly common in several European states. They were either of silver or gold; value of the former, 3s. to 4s., of the latter about 9s. 4d.

They were named from being first coined in one of the Italian duchies.

Ducatoon', formerly a Dutch silver coin worth 3 guilder 3 stivers, or 5s. 8d. sterling. There were coins of the same name in Italy. In Tuscany its value was about 5s. 5d., in Savoy slightly more, and in Venice about 4s. 9d.

Du Challu (dù-shā-yū), Paul Belloni, traveller, born in Paris 1835, died 1903. He spent his youth in the French settlement at the Gaboon, on the west coast of Africa, where his father was a merchant. In 1852 he went to the United States, of which he afterwards became a naturalized citizen. In 1855 he began his first journey through Western Africa, and stayed till 1859 alone among the different tribes, travelling on foot upwards of 8000 miles. He collected several gorillas, never before hunted, and rarely, if ever, before seen by any European. An account of this journey, *Explorations and Adventures in Equatorial Africa*, was published in 1861. A second expedition was made in 1863, an account of which, under the title *A Journey to Ashango Land*, appeared in 1867. *The Land of the Midnight Sun*, an account of a tour in Northern Europe (1881), had a considerable success. He published a number of books intended for boys, and based on his travels. One of his works is *The Viking Age* (1889), on the ancestors of the English-speaking peoples.

Duchesne, or Du Chesne (dù-shān), André, French historian, born in 1584, died in 1640. His most important works are his collection of French historians—*Historia Francorum Scriptores*; *Historia Normanorum Scriptores 838-1220*; *Histoire d'Angleterre, d'Ecosse, et d'Irlande*; *Histoire des Papes*.

Ducis (dù-sēs), Jean François, French dramatic writer, born at Versailles 1733, died 1816. Of his original works, the tragedy *Abufar* was much admired; but he is now best known for his adaptations of Shakespeare to the Parisian stage.

Duck, the name given to web-footed birds constituting the sub-family Anatinae of the family Anatidae, which also includes swans and geese. The ducks are very numerous as species, and are met with all over the world. They are often migratory, going northward in summer to their breeding-places. Their food is partly vegetable, partly animal. The common mallard or wild-duck (*Anas boschas*) is the original of the domestic duck. In its wild state the male is characterized by the deep green of the plumage of the head and neck, by a white collar separating the green from the dark chestnut of the lower part of the neck, and by having the four middle feathers of the tail recurved. The wild-duck is taken in large quantities by decoys and other means. Some tame ducks

have nearly the same plumage as the wild ones; others vary greatly, being generally duller or pure white, but all the males have the four recurved tail-feathers. There are several favourite varieties of the domestic duck, those of Normandy and Picardy in France, and the Aylesbury ducks in England, being remarkable for their great size and delicacy of flesh. Other species of the sub-family are: shoveller (*Spatula chrypeata*), garganey (*Querquedula circia*), pintail or sea-pheasant (*Dasila acuta*), teal (*Nettion crecca*), widgeon (*Mareca penelope*), gadwall (*Chaulelasmus streperus*), sheldrake (*Tadorna cornuta*), tree-ducks (species of *Dendrocygna*).



Mallard or Wild-duck

In a wider sense the name 'duck' is applied to species of other sub-families of the Anatidae as follows: Merganettinae: blue duck (*Hymenolaimus malacorhynchus*) of New Zealand. Eristaturinae: musk duck (*Biziura lobata*) of Tasmania and Australia. Lake ducks (species of *Eristatura*). Fuligulinae: cider duck (*Somateria mollissima*), q.v.; scoter or black duck (*Edemia nigra*); harlequin duck (*Colymbus septentrionalis*); logger-head or steamer duck (*Tachyeres cinereus*) of South America; scaup (*Fuligula marila*); canvas back (*F. vallisneria*), q.v.; pochard (*Nyroca ferina*). Plectopterinae: summer duck (*Aix sponsa*) of N. America and Cuba; mandarin duck (*A. galericulata*) of E. Asia; Muscovy or musk duck (*Cairina moschata*), ranging from Mexico to the Argentine.—BIBLIOGRAPHY: Nourse, *Turkeys, Ducks, and Geese*; Rankin, *Natural and Artificial Duck Culture*; J. G. Millais, *British Diving Ducks*.

Ducking-stool, a stool or chair in which common scolds were formerly tied and plunged

into water. They were of different forms, but that most commonly in use consisted of an upright post and a transverse movable beam on which the seat was fitted or from which it was suspended by a chain. The ducking-stool is mentioned in *Domesday Book* (Chester): it was extensively in use throughout the country from the fifteenth till the beginning of the eighteenth century, and in one case—at Leominster—was used as late as 1809.

Duckweed, the popular name of several species of Lemna, nat. ord. Lemnaceae, plants growing in ditches and shallow water, floating on the surface, and serving as food for ducks and geese. Five species are known in Britain, and others are common in America. They consist of small fronds bearing naked unisexual flowers.

Duckworth, Sir John Thomas, a British admiral, born in 1748, died 1817. He joined the navy when eleven years of age; and was post-captain in 1780. In 1793, on the breaking out of the French war, he was appointed to the command of the *Orian*, 74, forming part of the Channel fleet under Lord Howe, and distinguished himself in 1794 in the great naval victory on 1st June. In 1798 he aided in the capture of Minorca. From 1800 to 1806 he rendered important services on the West India station, in particular gaining a complete victory over a French squadron, for which he received a pension of £1000 a year and the thanks of both Houses of Parliament. In 1807, having been ordered to Constantinople, he forced the passage of the Dardanelles, but suffered severely from the Turkish batteries in returning. From 1810 to 1814 he commanded the Newfoundland fleet, and in 1817 he was appointed to the chief command at Plymouth. In 1813 he was created a baronet.

Duclos (dù-klô), Charles Pinot, a French novelist, writer of memoirs, and grammarian, born in 1704 at Dinant, died at Paris 1772. He became secretary of the French Academy, and on the resignation of Voltaire he was appointed to the office of historiographer of France. His writings are lively and satirical. Among the best are: *Confessions du Comte de \* \* \** (1741), *Considérations sur les Mœurs de ce Siècle*, *Mémoires secrets sur les Règnes de Louis XIV et XV*, and *Remarques sur la Grammaire générale de Port-Royal*.

Ductility, the property of solid bodies, particularly metals, which renders them capable of being extended by drawing, while their thickness or diameter is diminished, without any actual fracture or separation of their parts. The following is nearly the order of ductility of the metals which possess the property in the highest degree, that of the first mentioned being the greatest: gold, silver, platinum, iron, copper,

nickel, palladium, cadmium, zinc, tin, lead. Dr. Wollaston succeeded in obtaining a wire of platinum only  $\frac{300000}{1000000}$ th of an inch in diameter. The ductility of glass at high temperatures seems to be unlimited, while its flexibility increases in proportion to the fineness to which its threads are drawn.

**Duddon**, an English river which flows 20 miles along the boundaries of Cumberland and Lancashire to the Irish Sea, and is the subject of a series of sonnets by Wordsworth, written in 1820.

**Du Deffand**, Madame. See *Deffand*.

**Duderstadt** (dô'dér-stât), an old German town, province of Hanover, 10 miles east of Göttingen, formerly a member of the Hanseatic League and a place of some importance. Pop. 5880.

**Dudevant**, Madame. See *Sand, George*.

**Dudley**, Sir Edmund, born 1462, executed 1510, noted in English history as an instrument of Henry VII in the arbitrary acts of extortion by the revival of obsolete statutes and other unjust measures practised during the latter years of his reign. On the accession of Henry VIII he was arrested for high treason, and perished on the scaffold with his associate Sir Richard Empson.

**Dudley**, Lord Guildford, son of John, Duke of Northumberland, was married in 1553 to Lady Jane Grey, whose claim to the throne the duke intended to assert on the death of Edward VI. On the failure of the plot Lord Guildford was condemned to death, but the sentence was not carried into effect till the insurrection of Wyatt induced Mary to order his immediate execution (1554).

**Dudley**, John, Duke of Northumberland, son of Sir Edmund Dudley, minister of Henry VII, was born in 1502, beheaded 1553. He was left by Henry VIII one of the executors named in his will, as a kind of joint-regent during the minority of Edward VI. Under that prince he manifested the most insatiable ambition, and obtained vast accessions of honours, power, and emoluments. The illness of the king, over whom he had gained complete ascendancy, aroused his fears, and he endeavoured to strengthen his interest by marrying his son Lord Guildford Dudley to Lady Jane Grey, descended from the younger sister of Henry VIII, and persuaded Edward to settle the crown on his kinswoman by will, to the exclusion of his two sisters, the Princesses Mary and Elizabeth. The attempt to place Lady Jane Grey on the throne failed, and many of the conspirators were executed.

**Dudley**, Robert, Earl of Leicester. See *Leicester*.

**Dudley**, a town and parliamentary borough of England, in an isolated part of Worcestershire

enclosed by Staffordshire, 8 miles west by north of Birmingham. It is situated in the midst of the 'black country', and has extensive coal-mines, iron-mines, ironworks, and limestone quarries. It produces nails, chain-cables, anchors, vices, boilers, fire-irons, and has also glassworks, brickworks, and brass-foundries. There are the remains of a castle, said to have been founded in the eighth century by a Saxon prince called Dud, who has given the town its name. Dudley returns one member to Parliament. Pop. of municipal borough, 51,079.

**Dudley Limestone**, a highly fossiliferous limestone belonging to the Silurian system, occurring near Dudley, and equivalent to the Wenlock limestone. It abounds in beautiful masses of coral, shells, and trilobites.

**Duel** (Lat. *duellum*, from *duo*, two), a premeditated and prearranged combat between two persons with deadly weapons, for the purpose of deciding some private difference or quarrel. The combat generally takes place in the presence of witnesses called seconds, who make arrangements as to the mode of fighting, place the weapons in the hands of the combatants, and see that the laws they have laid down are carried out. The origin of the practice of duelling is referred to the trial by 'wager of battle' which obtained in early ages. This form of duel arose among the Germanic peoples, and a judicial combat of the kind was authorized by Gundebald, King of the Burgundians, as early as A.D. 501. When the judicial combat declined, the modern duel arose, being probably to some extent an independent outcome of the spirit and institutions of chivalry. France was the country in which it arose, the sixteenth century being the time at which it first became common, especially after the challenge of Francis I to Charles V in 1528. Upon every insult or injury which seemed to touch his honour, a gentleman thought himself entitled to draw his sword, and to call on his adversary to give him satisfaction, and it is calculated that 6000 persons fell in duels during ten years of the reign of Henri IV. His minister, Sully, remonstrated against the practice; but the king connived at it, supposing that it tended to maintain a military spirit among his people. In 1602, however, he issued a decree against it, and declared it to be punishable with death. Many subsequent prohibitions were issued, but they were all powerless to stop the practice. During the minority of Louis XIV, more than 4000 nobles are said to have lost their lives in duels. The practice of duelling was introduced into England from France in the reign of James I; but it was never so common as in the latter country. Cromwell was an enemy of the duel, and during the Protectorate there was a cessation of the practice. It came

again into vogue, however, after the Restoration, thanks chiefly to the French ideas that then inundated the court. As society became more polished duels became more frequent, and they were never more numerous than in the reign of George III. Among the principals in the chief duels of this period were Charles James Fox, Sheridan, Pitt, Canning, Castlereagh, the Duke of York, the Duke of Richmond, and Lord Camelford. The last mentioned was the most notorious duellist of his time, and was himself killed in a duel in 1804. A duel was fought between the Duke of Wellington and Lord Winchelsea in 1829, but the practice was dying out. It lasted longest in the army. By English law fatal duelling is considered murder, no matter how fair the combat may have been, and the seconds are liable to the same penalty as the principals. In 1813 the principal and seconds in a fatal duel were sentenced to death, though afterwards pardoned. An officer in the army having anything to do with a duel renders himself liable to be cashiered. In France duelling still prevails to a certain extent; but the combats are usually very bloodless and ridiculous affairs. In the German army until 1918 it was common, and was recognized by law. The duels of German students, so often spoken of, seldom cause serious bloodshed.—BIBLIOGRAPHY: Millingen, *History of Duelling*; Steinmetz, *Romance of Duelling*; G. Letainturier-Fradin, *Le duel à travers les âges*; C. A. Thimm, *Bibliography of Fencing and Duelling*; A. Hutton, *The Sword and the Centuries*.

Duenna, the chief lady-in-waiting on the Queen of Spain. In a more general sense, an elderly woman holding a middle station between a governess and companion, appointed to take charge of the young daughters of Spanish and Portuguese families.

Dufaure (dû-fôr), Jules Armand Stanislas, French orator and statesman, born 1798, died 1881. He practised law at Bordeaux; entered the Chamber of Deputies in 1834, and became an influential leader of the Liberal party. Under the Republic he was Minister of the Interior, but was driven from the public service by the *coup d'état* of 1851, and for the next twenty years devoted himself closely to his Bar practice and pamphlet writing. Under the Government of Thiers he acted as Minister of Justice; and in 1876, and again from 1877 to 1879, he was head of the Cabinet.

Duff, Alexander, Scottish missionary, born 1806, died 1878. Educated at St. Andrews University, in 1829 he set out for India as the first Church of Scotland missionary to that country, and reached Calcutta after being twice shipwrecked. He opened a school in which he taught successfully the doctrines of Christianity,

as well as general knowledge, but on his secession (along with the other missionaries of the Church) from the Church of Scotland in 1843, he had to give up the school and begin again. In 1849 he visited Scotland, where he remained until 1856. He assisted in founding the University of Calcutta, and, having been obliged to return home for reasons of health, he raised £10,000 to endow a missionary chair in the New College, Edinburgh, becoming himself its first occupant. His chief writings are: *The Church of Scotland's India Mission* (1835); *Vindication of the Church of Scotland's India Mission* (1837); *India and India Missions* (1840); *The Jesuits* (1845); and *The Indian Mutiny: its Causes and Results* (a series of letters published in 1858).

Duff, Sir Mountstuart Elphinstone Grant, writer on political and other subjects, born in Aberdeenshire in 1829, died in 1906. He was educated at Edinburgh Academy, The Grange, Bishop Wearmouth, and Balliol College, Oxford, was called to the Bar at the Inner Temple in 1854, and in 1857 entered the House of Commons as Liberal member for the Elgin Burghs, which constituency he continued to represent until 1881. He was Under-Secretary for India in W. E. Gladstone's ministry from 1868 to 1874, and Under-Secretary for the Colonies from 1880 to 1881, in which latter year he was appointed Governor of Madras. His Indian administration was most successful, and on his retirement in 1886 he was made a G.C.S.I. He was president of the Royal Geographical Society from 1889 to 1893, and of the Royal Historical Society from 1892 to 1899, and was also a trustee of the British Museum. His published works include: *Studies in European Politics* (1866); *A Political Survey* (1868); *Elgin Speeches* (1871); *Notes of an Indian Journey* (1876); *Miscellaneous, Political and Literary* (1879); *Memoir of Sir H. S. Maine* (1892); *Ernest Renan* (1893); and *Notes from a Diary* (7 vols., 1897-1905).

Duff'erin and Ava, Frederick Temple Hamilton-Blackwood, Marquess of, British statesman and author, son of the fourth Baron Dufferin and a granddaughter of R. B. Sheridan, born at Florence 1826, died in 1902. He began his public services in 1855, when he was attached to Earl Russell's mission to Vienna. Subsequently he was sent as Commissioner to Syria in connection with the massacre of the Christians (1860); was Under-Secretary of State for India (1864-6); Under-Secretary for War (1866); Chancellor of the Duchy of Lancaster (1868-72); Governor-General of Canada (1872-78); Ambassador at St. Petersburg (1879-81); at Constantinople (1882); sent to Cairo to settle the affairs of the country after Arabi Pasha's rebellion (1882-3); Viceroy of India (1884-8); Ambassador to Italy (1889-91); to France (1891-96). He

was elected president of the Royal Geographical Society in 1878, and Lord Rector of Glasgow University in 1891. Besides being a noted diplomatist, he was also a popular author. In 1847 he published *Narrative of a Journey from Oxford to Skibbereen during the year of the Irish Famine*; in 1860, *Letters from High Latitudes*; also various pamphlets on Irish questions. In 1888 he was made Marquess of Dufferin and Ava. —Cf. Sir A. Lyall, *Life of the Marquess of Dufferin and Ava*.

**Dufrénoy** (dû - frè - nwā) Pierre Armand, French geologist and mineralogist, born in 1792, died in 1857. He became director of the school of mines, and published a great variety of papers on geology and mineralogy. In 1841 he published, in collaboration with Élie de Beaumont, a great geological map of France with three volumes of text, and this was followed by his *Traité de Minéralogie*. He introduced a new classification of minerals, based on crystallography.

**Dufresny** (dû-frā-nē), Charles Rivière, a French comic poet, born in 1648, died in 1724. He was clever and versatile, and had great skill as a landscape-gardener and an architectural designer. Among his dramatic pieces may be mentioned *L'Esprit de Contradiction*, *Le Mariage Fait et Rompu*, and *Le Double Veuvage*. He also wrote *Amusements sérieux et comiques d'un Siamois*, which suggested to Montesquieu his *Lettres Persanes*.

**Dugdale**, Sir William, an English antiquary, born in 1605 of a good family in Warwickshire, died 1686. He was made Chester herald in 1644; accompanied Charles I through the civil war; and after the Restoration received knighthood, and was appointed garter king-at-arms. In concert with Roger Dodsworth he produced an important work on English monasteries entitled *Monasticon Anglicanum*. Among his other works are: *Antiquities of Warwickshire*; *The Baronage or Peerage of England*; *Origines Judiciales, or Historical Memoirs of the English Law, Courts of Justice, &c.*; a *History of St. Paul's Cathedral*; and various minor writings. He also completed and published the second volume of Spelman's *Concilia*.

**Dug'ong**, a herbivorous mammal, the *Halicore dugong*, belonging to the ord. Sirenia, which also includes the manatees. It is a native of the Indian and Australian seas; possesses a tapering body ending in a crescent-shaped fin, and is said sometimes to attain a length of 20 feet, though generally it is about 7 or 8 feet in length. The fore-limbs are in the form of flippers; hind-limbs are absent. The skin is thick and smooth, with a few scattered bristles; the colour bluish above and white beneath. Its food consists of marine plants; it yields little or no oil, but is hunted by the Malays for its

flesh, which resembles veal, and is tender and palatable. It has been suggested that the appearance of this animal has given rise to the legends of mermaids and mermen.

**Duguay-Trouin** (dû-gā-tro-au), René, a distinguished French seaman, born at St. Malo in 1673, died at Paris 1736. As commander of a privateer he took many prizes from the British between 1690 and 1697. He then entered the royal marine as a captain, and signalized himself so much in the Spanish War that the king granted him letters of nobility, in which it was stated that he had captured more than 300 merchant ships and twenty ships of war. By the capture of Rio de Janeiro (1711) he brought the Crown more than 25,000,000 francs. Under Louis XV he rendered important services in the Levant and the Mediterranean.

**Du Guesclin** (dû-gā-klan), Bertrand, Con-



Dugong (*Halicore dugong*)

stable of France, born about 1314, died 1380. Mainly to him must be attributed the expulsion of the English from Normandy, Guienne, and Poitou. He was captured by Chandos at the battle of Auray in 1364, and ransomed for 100,000 francs. While serving in Spain against Peter the Cruel, he was made prisoner by the English Black Prince, but was soon liberated. For his services in Spain he was made Constable of Castile, Count of Trastamare, and Duke of Molinas; and in 1370 he was made Constable of France.

**Dulkerbok**, species of *Cephalophus*, small South African antelopes with short horns (none in the female), and a tuft of stiff hairs between them.

**Dulsburg** ('5's-burk), a flourishing town in Rhenish Prussia, 13 miles north of Düsseldorf. It is an ancient place, believed to be of Roman origin. It early rose to be a free town, and became a member of the Hanseatic League. It possesses a beautiful church of the fifteenth century, and has iron manufactories, engineering works, chemical works, and cotton and woollen mills; and a large trade greatly facilitated by a canal communicating with the Rhine, which is about 2 miles distant. Pop. 229,483.

**Dujardin** (dû-zhâr-dan), Karel, a Dutch artist, who excelled in painting landscapes,

animals, and scenes in low life, born in 1640 at Amsterdam, died at Venice 1678. His paintings are rare, and command high prices. His masterpiece, *The Charlatans* (1657), is in the Louvre.

**Duke** (Fr. *duc*, Sp. *duque*, It. *duca*, all from Lat. *dux*, leader, commander), a title belonging originally to a military leader. In Britain it is the highest rank in the peerage. Royal dukes have a special status and precedence. The first hereditary duke in England was the Black Prince, created by his father, Edward III, in 1336. The duchy of Cornwall was bestowed upon him, and was thenceforward attached to the eldest son of the king, who is considered a duke by birth. The duchy of Lancaster was soon after conferred on Edward's third son, John of Gaunt, and hence arose the special privileges which these two duchies still in part retain. A duke in the British peerage, not of royal rank, is styled 'your grace', or 'my Lord Duke'; his wife is a duchess. (See *Address, Forms of*.) The coronet consists of a richly-enameled gold circle, having on its upper edge eight golden leaves of a conventional type called strawberry leaves; the cap of crimson velvet is closed at the top with a gold tassel, lined with sarsenet, and turned up with ermine. (See *Coronet*.) At various periods and in different continental countries the title duke (*Herzog* in Germany) was given to the actual sovereigns of small states. The titles 'grand-duke' and 'grand-duchess', 'arch-duke' and 'archduchess', were in use also on the European continent, especially in Russia and Austria until 1918. In the Bible the word *dukes* is used (*Gen. xxxvi*) for the *duces* of the *Vulgate*.

**Dukhoborzi** (dŭk-o-bor'tsē), a Russian sect of religious mystics which arose in the eighteenth century. The name means 'spirit-fighters', as the sect was accused by the orthodox priests of fighting against the spirit of God. They reject the doctrine of the Trinity, of the deity of Christ, hold property in common, and refuse oaths and military service, thus resembling Quakers. In 1899 a body of several thousands emigrated to Canada, where they received territory in Assiniboia and Saskatchewan.

**Dukinfield, or Duckinfield**, a municipal borough, England, county Cheshire, separated by the Tame from Ashton-under-Lyne, and mostly within Stalybridge parliamentary borough. Collieries, cotton-factories, brickworks, and tileworks give employment to the population. Pop. (municipal borough), 19,426.

**Dulce** (dŭl'sā), a lake of Guatemala, on the east coast, communicating with the Gulf of Honduras by the lakelet el Golfete. It is about 80 miles long by 12 broad, and affords profitable turtle hunting.

**Dulcigno** (dŭl-chēn'yō), a small seaport town,

formerly in Albania, now in Montenegro, on the Adriatic, the seat of a Roman Catholic Bishop. It was captured by the Austrians in 1916, and retaken by Italian troops in 1918. Pop. 5000.

**Dulcimer**, one of the most ancient musical instruments, used in almost all parts of the world. The modern instrument consists of a shallow trapezium-shaped box without a top, across which runs a series of wires, tuned by pegs at the sides, and played on by being struck by two cork-headed hammers. It is in much less common use in Europe now than it was a century or two ago, and is interesting chiefly as being the prototype of the piano. It is still, however, occasionally to be met with on the Continent at fairs in the country, and in England in the hands of street musicians. It was known in Persia and Arabia under the name of *santir*, and was intro-



Italian Dulcimer

duced into Europe by the Crusaders. The Hebrew psaltery is supposed to have been a variety of the dulcimer.

**Dulcinists**, followers of Dulcinus, a layman of Lombardy, in the fourteenth century, who preached the reign of the Holy Ghost, affirming that the Father had reigned till Christ's incarnation, and that the Son's reign terminated in 1300. He was followed by a great many people to the Alps, where he and his wife were taken and burned by order of Clement IV.

**Dulcitol**, or **Dulcite**, is an alcohol closely allied to the sugars. It is found in Madagascar manna, from which it is extracted by boiling water.

**Dull'a** (Gr. *douleia*, service, from *doulos*, a slave), an inferior kind of worship or adoration, as that paid to saints and angels in the Roman Catholic Church. The Catholics recognize different degrees of worship. The lowest degree is the *dulla*, which is given to saints and angels. *Hyperdulia* is reserved for the Virgin alone; and *latria* is given to God and to each person of the Trinity.

**Dulse**, a red sea-weed, the *Rhodymenia pal-māta*, used in some parts of Scotland as an edible. It has a reddish-brown, or purple, leathery, veinless frond, several inches long, and is found at low water adhering to the rocks. It is an important plant to the Icelanders, and is stored by them in casks to be eaten with fish. In Kamchatka a fermented liquor is made from it. In the south of England the name is given to the *Iridaea edulis*, also an edible red sea-weed.

**Duluth** (du-lŭth'), a town of the United States,



capital of St. Louis county, Minnesota, at the south-west extremity of Lake Superior. The Northern Pacific and Lake Superior and Mississippi railways terminate here; and extensive docks and other works have been constructed, affording a convenient outlet for the surrounding wheat region. Pop. 97,077.

Dulwich (dul'ich), a suburb of London, in County Surrey, about 5 miles south of London Bridge, giving name to a parliamentary division of the borough of Camberwell; noticeable on account of its school, *Dulwich College*, called the 'College of God's Gift', founded as a charitable institution in 1619 by the actor Edward Allen or Alleyn. Four parishes were benefited by the charity: St. Luke's, Middlesex; St. Botolph's, Bishopsgate; St. Saviour's, Southwark; and St. Giles', Camberwell. Having outlived its usefulness, in 1857 an Act was passed by which the college was reconstituted. It now consists of two branches, the educational and the eleemosynary, between which the surplus revenue is divided in the proportion of three-fourths to the former and one-fourth to the latter. The educational branch comprises two schools, the upper and the lower; the former giving boys a high-class education (lower fees for those of the privileged parishes), and having a number of scholarships and exhibitions. The eleemosynary branch maintains a certain number of resident and non-resident poor people. The original revenues were only £800, but now amount to £20,000. Dulwich College is celebrated for its pictures, many of which were bequeathed by the founder; but the greater and more valuable portion of them was the bequest of Sir Francis Bourgeois, a landscape-painter, who died in 1810. The collection includes many fine pictures of the Dutch school.

Duma, or Douma, the Lower House of the former Russian Parliament, the Upper House being the Council of the Empire. In 1905 Tsar Nicholas II granted his country a Constitution, promising that responsible Government would be established, and that no law would be made effective without the consent of the Duma. The first Duma accordingly met in 1906, and was to have had the power of a Parliament in Constitutional countries. The Legislative Assembly could make new laws, modify existing ones, issue the national Budget, &c., but had no right to alter the fundamental laws of the empire. In spite of the promises, however, given by the Tsar, the Imperial Government paid no attention to the demands of the Assembly, and when the criticisms of the Deputies became too loud, the first Duma was dissolved. A second Duma assembled the next year, but its members, in consequence of governmental restrictions on elections, were mostly Conservatives. In the

opinion of the Government, however, even the second Duma was too Liberal in its tendencies, and it was promptly dissolved. The third Duma, which met in 1907, and whose members were mostly landed proprietors, retired officers, and priests, was absolutely subservient to the autocratic Government, and, from that date to the outbreak of the Russian Revolution in 1917, the power and influence of the Russian Duma were almost nil. The Duma ceased to exist on 7th Nov., 1917, when the Bolsheviks came into power, and the Government of Commissaries of the People was set up.

Dumas (dû-mä), Alexandre (called *Dumas Père*), French novelist and dramatist, born at Villers-Cotterets 1803, died at Puys, near Dieppe, 1870. He was the son of a republican general, and grandson of the Marquis de la Pailleterie and a negress, Tiennette Dumas. In 1823 he went to Paris, and obtained an assistant-secretaryship from the Duke of Orleans, afterwards Louis Philippe. He soon began to write for the stage, and in 1829 scored his first success with his drama *Henri III et sa cour*. It was produced when the battle between the Romanticists and the Classicists was at its height, and hailed as a triumph by the former school. The same year appeared his *Christine*, and in quick succession *Antony*, *Richard d'Arlington*, *Térésa*, *La Tour de Neale*, *Catharine Howard*, and *Mlle de Belle-Isle*. Dumas had now become a noted Parisian character. The critics fought over the merits of his pieces, and the scandal-mongers over his prodigality and *galantries*. Turning his attention to romance, he produced a series of historical romances, among which may be mentioned: *Le duc de Moulton*; *Isabelle de Bavière*; *Les Deux Dames*; *La Reine Margot*; *Les Trois Mousquetaires*, with its continuations *Vingt Ans Après* and the later *Vicomte de Bragelonne*. His *Monte-Cristo* and several others are also well known to English readers through translations. Several historical works were also written by him: *Louis XIV et son Siècle*, *Le Regent et Louis XV*, *Le Drame de '93*, *Florence et les Médicis*, &c. The works which bear his name amount to some 1200 volumes, including about 60 dramas; but the only claim he could lay to a great number of the productions issued under his name was that he either sketched the plot or revised them before going to press. He earned vast sums of money, but his recklessness and extravagance eventually reduced him to the adoption of a shift, scheming mode of living. His *Mémoires*, begun in 1852, present interesting sketches of literary life during the Restoration, but display intense egotism. In 1860 he accompanied Garibaldi in the expedition which freed Naples from the Bourbons. He died at the residence of his son, and was buried in Villers-Cotterets in



1872. Dumas was remarkable for his creative rather than for his artistic genius, and although he frequently squandered his gifts, he was admired even by the highly cultured, such as Thackeray and others.—BIBLIOGRAPHY: H. Blaze de Bury, *Alexandre Dumas: sa vie, son temps, son œuvre*; A. B. Davidson, *Alexandre Dumas père: his Life and Works*.

Dumas, Alexandr' son of the above, born 1824, died in 1895, novelist and dramatist. His works treat mostly of the relations between vice and morals. His first novels, *La Dame aux Camélias* and *Diane de Lys*, were very successful, as were also the plays which were founded on them. His dramas, which are much superior to his novels, deal satirically with the characters, follies, and manner. of French society. He was thus a pioneer in the 'comedy of manners'. His plays, besides his dramatized novel *La Dame aux Camélias*, which marked a date in the history of the French stage, and which supplied Verdi with the plot for *La Traviata*, are: *Le demi-monde*, *Le fils naturel*, *L'Ami des femmes*, *La princesse Georges*, and *L'Étrangère*.

Dumas, Matthieu, French soldier and military writer, born in 1753, died in Paris 1837. He early entered the French cavalry, took part in the War of American Independence, and was employed in the Levant and in Holland. At the commencement of the Revolution he assisted Lafayette in organizing the National Guard. On the triumph of the extreme party in 1797 Dumas was proscribed, but made his escape to Holstein, where he wrote the first part of his *Précis des Événements Militaires*, a valuable source for the history of the period of which it treats (1798–1807). He was recalled from exile by Napoleon, who had become First Consul. His first employment was to organize the reserve for the army of Italy. In 1802 he was appointed State Councillor; in 1805 he became general of division, and was shortly afterwards Neapolitan minister in the service of Joseph Bonaparte. In 1808 he was actively employed in the arrangements for the war against Austria, fought in the battles of Essling and Wagram, and arranged the terms of the armistice of Znaim. He held the office of General Intendant of the army in the campaign of 1812. After the Restoration Louis XVIII appointed him Councillor of State, and gave him several important appointments connected with the army. In 1830 he aided in bringing on the revolution of July, and after the fall of Charles X he obtained the chief command of all the national guards of France, together with a peerage. He published a translation of Napier's *History of the Peninsular War*.

Du Maurier (dû-mô'ri-ä), George Louis Palmella Busson, artist and writer, was born in Paris 1834, died in 1896. He was the son of an

English mother and a Frenchman who had been naturalized as a British subject. At the age of seventeen he took up the study of chemistry in London, but soon adopted art as a profession. After studying in Belgium and France, he returned to London, and soon began to contribute drawings to *Punch*, *Once a Week*, *Cornhill Magazine*, &c. He succeeded Leech on *Punch*, and became famous chiefly through his drawings for that publication. He also illustrated various books, and wrote three novels, *Trilby*, *Peter Ibbetson*, and *The Martian*. His elder son, Guy Du Maurier, born in 1865, killed in France in 1915, was the author of *An Englishman's Home* (1909).

Dumba, Konstantin Theodor, Austro-Hungarian diplomatist, who became conspicuous as an agent of German propaganda in the United States during the European War. He went as Ambassador to the United States in 1913, and at the outbreak of the war endeavoured to organize a vast conspiracy there, with a view to hampering the productions of munitions for the Allies. Abusing his position of Ambassador, he planned explosions and strikes in American factories. On 1st Sept., 1915, J. F. J. Archibald, an American newspaper correspondent, was arrested at Falmouth, and among the papers found upon him was a letter from Dr. Dumba to Baron Burian, Austrian Minister for Foreign Affairs, wherein the former suggested a plan of crippling the munition factories in America by creating strikes. President Wilson then demanded his recall, and he left the United States in Oct., 1915, Great Britain granting him a safe conduct.

Dumbarton, a royal and parliamentary burgh and seaport, Scotland, chief town of Dumbarton county, stands on the Leven near its junction with the Clyde, 16 miles w.n.w. of Glasgow. Shipbuilding is carried on to a great extent, and there are foundries and engine-works. Dumbarton, since 1918, unites with Clydebank (Dumbarton District of Burghs), in sending a member to Parliament. Originally it was called Al-luyd, and it was the chief town of Cumbria or Strathclyde. Pop. 21,989. A little to the south is the famous rock and castle of Dumbarton, rising above the Clyde. The rock, which is of basalt, is 240 feet in height, and about 1 mile in circumference at the base. It is one of the fortresses stipulated to be kept in repair by the Act of Union, and the barracks contain accommodation for 150 men. There has been a stronghold here from the earliest times, and the fortress of Dumbarton occupied an important place in Scottish history.—*Dumbartonshire*, the county of Dumbarton, is partly maritime, partly inland, consisting of two detached portions, the larger and most westerly lying between the Clyde, Loch Long, and Loch Lomond, and the far smaller portion being about 4 miles east of the

former, and comprising only two parishes. More than half the area of the county is occupied by mountains, some of them attaining a height of upwards of 3000 feet. The lower lands are fertile, and in general well cultivated. More than one-half of Loch Lomond and fully two-thirds of the islands in it belong to Dumbartonshire. The Gareloch, an arm of the Firth of Clyde, forms a part of the county into a peninsula. The principal rivers are the Leven, from Loch Lomond, and the Kelvin, both belonging to the Clyde system. The chief minerals are coal, limestone, ironstone, and slate, all of which are wrought more or less. On the banks of the Leven and elsewhere are extensive cotton printing and bleaching establishments; and there are extensive shipbuilding yards along the Clyde. Besides Dumbarton, the chief town, the county contains the towns of Helensburgh and Kirkintilloch, and the manufacturing villages of Alexandria, Renton, and Bonhill. Vestiges of the Roman wall of Antoninus still exist. The county returns one member to the House of Commons. Pop. 139,831.

**Dumb-cane**, a plant of the ord. Araceæ, the *Dieffenbachia seguina*, of the West Indies, so called from its acidity causing swelling of the tongue when chewed, and destroying the power of speech.

**Dumdum**, a military village and extensive cantonment, Hindustan, province of Bengal,  $4\frac{1}{2}$  miles E.N.E. of Calcutta. The village is famous as being the scene of the first open manifestation of the sepoys against the greased cartridges, which led to the mutiny of 1857. Pop. 12,000.

**Dumdum Bullet** (so called from the arsenal at Dumdum, a small village  $4\frac{1}{2}$  miles from Calcutta), a hollow-nosed bullet which expands on impact, and so causes an ugly wound. It was used in Indian frontier fighting to stop the rushes of fanatical tribesmen. While the term 'Dumdum' bullet should strictly only be applied to hollow-nosed bullets, it is popularly applied to any kind of expanding bullet. Ordinary bullets can be converted into expanding ones by means of filing the cupro-nickel envelope until the lead core is exposed, by means of slitting the envelope at the shoulders, or simply by reversing the bullet in its socket. Expanding bullets are considered legitimate in big-game shooting, but in the Declaration signed at the Hague, 29th July, 1899, Germany expressly promised not to use such bullets in warfare. In spite of this the Germans freely used bullets of this kind in the European War.

**Dumfries** (dun-frēs'), a river port, railway centre, and until 1918 a parliamentary burgh, Scotland, capital of the county of same name, and the chief place in the south of Scotland; situated on the left bank of the Nith, about

6 miles from its junction with the Solway Firth. It is connected with the suburb Maxwelltown (in Kirkeudbright) by three bridges, one dating from the thirteenth century. It is a pleasing, well-built town, with various handsome public edifices. There are iron-foundries, hosiery and tweed factories, tanneries, and coach-building works. The River Nith is navigable to the town for vessels of under 60 tons, but the port has decreased in importance since the development of the railway system. Dumfries is a place of great antiquity. The church of the Minorites which once stood here was the scene of the murder of the Red Comyn by Bruce in 1306. Burns spent his closing years here, and the street in which he lived now bears his name. His remains rest under a handsome mausoleum, and a statue of him was erected in 1882. Dumfries was the head-quarters of the Young Pretender in 1745. Until 1918 Dumfries united with Annan, Sanquhar, Lochmaben, and Kirkeudbright (the Dumfries burghs) in sending a member to Parliament. Pop. 19,076.—*Dumfriesshire*, the county of Dumfries, abuts on the Solway Firth, having on its borders the counties of Lanark, Peebles, Selkirk, Roxburgh, Ayr, and Kirkeudbright; area about 1100 sq. miles or 702,946 acres, of which about a third is under cultivation. The surface is irregular, but for the most part mountainous, especially in the north and north-west districts, where the hills attain a considerable elevation, some of them exceeding 2000 feet. The dales of the Nith, Annan, and Esk, the chief rivers of the county, contain fine pasture holms and good arable land. Oats, potatoes, and turnips are the most common products. Good cattle are reared, and are much in request for the English market. The sheep on the hill pastures are mostly Cheviots; on the lower and arable lands the Leicester breed prevails. The minerals most abundant are coal, lead, iron, antimony, and gypsum. Coal and lead are worked to a small extent. Limestone and freestone abound in various parts. There are no manufactures worth mentioning. The county returns one member to the House of Commons. Its principal towns are Dumfries, Annan, Sanquhar, Lockerbie, Moffat, Lougholm, and Lochmaben. Pop. 72,825.

**Dumont** (dü-môn), Pierre Étienne Louis, the friend and literary assistant of Mirabeau and Jeremy Bentham, was born at Geneva in 1739, died at Milan 1820. Ordained a minister of the Protestant Church in 1781, he attached himself to the democratic party in Geneva, and when the opposite party gained the ascendancy he went to St. Petersburg, in 1782, where he was appointed pastor of the French Reformed Church. Soon after he accepted an offer to act as tutor to the sons of Lord Shelburne, afterwards Marquess of

Lansdowne, which brought him to London, where he became intimate with Jeremy Bentham and Sir Samuel Romilly. Visiting Paris during the first years of the Revolution, he gained the friendship of Mirabeau, whom he assisted in the composition of speeches and reports, and of whom he wrote some interesting *Recollections*. On his return to London he formed that connection with Bentham which fixed his career as a writer; recasting, popularizing, and editing Bentham's works in a form suitable for the reading public. He returned to Geneva in 1814 and became a Senator.

Dumont d'Urville (dù-môn dūr-vêl), Jules Sebastien César, French navigator, was born in 1790, killed in a railway accident between Paris and Versailles 1842. After completing his studies at Caen, he entered the French navy, in which he ultimately rose to be rear-admiral. From 1820 to 1829 he commanded the corvette *Astrolabe*, which was sent to obtain tidings of La Pérouse, and to make hydrographic observations. He made surveys of the coasts of Australia and New Zealand, and found remains of the shipwreck of La Pérouse on one of the Pacific islands. The result of this voyage was the publication of *Voyage de Découverte autour du Monde*. In 1837 he sailed with the *Astrolabe* and *Zélée* on a voyage of Antarctic discovery, and after many dangers, and having visited many parts of Oceania, he returned in 1840. On his return he began the publication of *Voyage au Pôle sud et dans l'Océanie*, which was finished by one of his companions.

Dumouriez (dù-mô-ri-ä), Charles François Duperrier, a French general of great military talent, was born at Cambrai in 1739 of a noble family of Provence, died near Henley-on-Thames 1823. He served as an officer in the Seven Years' War. In 1768 he went to Corsica as quartermaster-general of the small army which was sent for the conquest of that island, and was afterwards made colonel. In 1778 he was appointed Governor of Cherbourg. At the Revolution he joined the Jacobins, and subsequently the Girondists, and in 1792 he was Minister of Foreign Affairs. War breaking out between France and Austria, he resigned in order to take command of the army; invaded Flanders, and defeated the Austrians at Jemappes and conquered Belgium. Instead of prosecuting the war vigorously, he now entered upon measures for the overthrow of the Revolutionary Government, issued a proclamation, in which he promised the restoration of the constitutional monarchy in the person of the heir to the crown, but was attacked by the Versailles volunteers, and compelled to flee (4th April, 1793). The Convention set a price of 800,000 livres upon his head. At first he retired to Brussels, and after

various wanderings found a final refuge in England. His *Memoirs*, written by himself, appeared in 1794; an enlarged edition in 1822. He was also the author of a large number of political pamphlets.—BIBLIOGRAPHY: J. Holland Rose and A. M. Broadley, *Dumouriez and the Defence of England against Napoleon*; H. Welschinger, *Le Roman de Dumouriez*.

Düna (dū'nä), or Western Dvina, a river of Russia, which rises in the government of Tver, about 15 miles w. of the source of the Volga, falls into the Gulf of Riga, has a course of about 650 miles, and waters the seven governments of Tver, Pskov, Vitebsk, Mogilev, &c., draining an area of about 65,000 sq. miles. It is navigable for a considerable distance, but is frozen for about four months each year.

Dünaburg (dū'nä-burg), Dvinaburg, or Dvinsk, a fortified town in Latvia, formerly belonging to Russia, in the government of Vitebsk on the right bank of the Düna, or Dvina, 112 miles south-east of Riga. It carries on various industries, a considerable trade, and has three yearly fairs. The official name is Dvinsk, or Daugavpils. It was captured by the Germans in Feb., 1918. Pop. 110,912.

Dünamünde (dū'nä-mün-de; 'Dünamouth'), a fortress and port on the Gulf of Riga, at the mouth of the Düna, having a large winter harbour for the shipping of Riga. Pop. 2500.

Dunbar', William, the most eminent of all the old Scottish poets, was born, probably in East Lothian, about 1460-5. In 1475 he went to St. Andrews, where, in 1477, he took the degree of B.A., and two years later that of M.A. After this he seems to have become a begging friar of the Franciscan order, and made journeys in England and France, but he returned to Scotland about 1490, and attached himself to the court of James IV, from whom he received a pension of £10. On the marriage of James IV to Margaret of England Dunbar celebrated the event in a poem of great beauty, entitled *The Thristil and the Rois*. His pension was ultimately raised to £80 a year, and he was the recipient of various additional gratuities, though he appears frequently to have addressed both the king and the queen for a benefice, but always without success. After the defeat at Flodden his name disappears from the royal accounts, and he probably died about 1520. His works, which consist of elaborate allegories, satirical and grimly humorous pieces, and poems full of brilliant description and luxuriant imagination, first collected by David Laing (Edinburgh, 1834), were edited by John Small and Æ. J. G. Mackay, for the Scottish Text Society, between 1884 and 1893.—Cf. *The Cambridge History of English Literature* (vol. II).

Dunbar' (Gael., Castle Point), a town of

Scotland; a royal and municipal (formerly parliamentary) burgh and seaport in Haddingtonshire, at the mouth of the Firth of Forth. It is a place of great antiquity, having originated in a castle, once of great strength and importance, which underwent several memorable sieges, on one occasion being successfully defended (in 1888) against the English for nineteen weeks by Black Agnes of Dunbar, Countess of March. In 1650, at the 'Race of Dunbar', Cromwell totally defeated the Scottish army under David Leslie near the town. The harbour is not very commodious, but the town is an important fishing-station. Pop. 4830.

**Dunblane'**, an old episcopal city, Scotland, in Perthshire, 6 miles north-east of Stirling, on the Allan. The ancient cathedral, partly in ruins, dates from the twelfth century. The nave is 130 feet by 58 feet, and the choir, now the parish church, is 80 feet by 30 feet. The building was restored in 1893. Bishop Leighton held the see from 1602 to 1670. About two miles from the town the indecisive battle of Sheriffmuir was fought in 1715, between the Royal forces under the Duke of Argyle, and the Jacobites under the Earl of Mar. Pop. 4600.

**Dun'can**, Adam, Viscount, a British naval officer, was born in Dundee in 1731, died 1804. He went to sea when young, and was a post-captain in 1761. In the following year he served at the taking of Havana; and in 1779 he shared in the victory of Admiral Rodney over the Spaniards. In 1789 he became rear-admiral of the blue, and in 1794 vice-admiral of the white squadron. The following year he was appointed commander of the North Sea fleet, and in Oct., 1797, won a brilliant victory over the Dutch fleet off Camperdown, for which he was rewarded with the title of Viscount Duncan of Camperdown and a pension of £2000 a year.

**Duncan**, Thomas, an eminent Scottish painter, was born in 1807, died at Edinburgh 1845. He studied under Sir W. Allan, and was elected an associate of the Royal Academy in 1843. His principal works were illustrative of Scottish history and character. Among the best known of them are: *The Abdication of Mary Queen of Scots*, *Anne Page and Slender*, *Prince Charles Edward and the Highlanders entering Edinburgh after Prestonpans*, *Charles Edward asleep in a Cave after Culloden*, and *The Martyrdom of John Brown of Priesthill*.

**Dun'cansby Head**, a promontory in Caithness-shire, Scotland, forming the N.E. extremity of the Scottish mainland,  $1\frac{1}{2}$  miles E. of John o' Groat's House, and  $18\frac{1}{2}$  miles N. by E. of Wick. Close by the promontory are two rocks, of fantastic form and great height, called the Stacks of Duncansby, which in spring and summer are covered with sea-fowl.

**Dundalk** (dun-dalk'), a seaport and former parliamentary borough, Ireland, capital of the county of Louth, on Castletown River, about 2 miles above its mouth in Dundalk Bay. It has railway workshops, tanyards, and a spinning-mill; the trade, chiefly in cattle and agricultural produce, is extensive. It was the seat of the court of Edward Bruce from 1315 to 1318. In 1649 it was captured by Cromwell. Pop. 13,128.

**Dundas'** of Arncliffe, the name of a family several members of which held a conspicuous place in the legal and political history of Scotland.—Sir James Dundas, the first of Arncliffe, knighted by James VI, was the third son of George Dundas of Dundas, a descendant of the Dunbars, Earls of March.—His eldest son, Sir James, was member of Parliament for Mid-Lothian, and was appointed one of the judges of the Court of Session (1662).—His eldest son Robert was also raised to the bench of the Court of Session, and filled that station for thirty-seven years. He died in 1727.—His eldest son Robert (1685-1753) was successively Solicitor-General for Scotland, Lord-Advocate, member of Parliament for the county of Edinburgh, and Dean of the Faculty of Advocates. In 1737 he was raised to the bench, and on the death of Lord-President Forbes of Culloden, in 1748, he was appointed his successor.—His eldest son Robert (1713-87) also attained to the position of Lord-Advocate, and Lord-President of the Court of Session.—His brother Henry Dundas, Viscount Melville, distinguished statesman, was born in 1741 and died 1811. He obtained the post of Solicitor-General in 1773, that of Lord-Advocate in 1775, and was made joint keeper of the signet for Scotland in 1777. In 1782 he was appointed Treasurer of the Navy and member of the Privy Council; and from that time took a leading part in all the Pitt measures, and had supreme influence in Scotland. Among other offices he held that of First Lord of the Admiralty; and in 1805 he was impeached before the House of Lords of high crimes and misdemeanours in his former office of Treasurer of the Navy, but was finally acquitted. He was created Viscount Melville in 1801, a title still borne by his direct descendant.

**Dundee'**, John Graham of Claverhouse, Viscount. See *Graham*.

**Dundee** (Gael. *Dun Taw*, fort on the Tay), a city, royal and parliamentary burgh, and seaport, Scotland, in the county of Forfar, on the north shore of the Firth of Tay, about 8 miles from the open sea, 37 miles N.N.E. of Edinburgh; in population the third town in Scotland. It stretches along the Tay, or east to west, and of late years has been greatly extended in both directions. The more recently made streets are spacious and handsome, but most of those of

more ancient date are narrow, and irregularly built. The most conspicuous building is St. Mary's Tower, or the Old Steeple as it is popularly called, 156 feet high, erected in the middle of the fourteenth century. Three modern parochial churches have been built on to it in form of a cathedral, the nave, choir, and transept respectively forming a separate church. Among public buildings are: the town hall, several public halls, the high school, exchange, infirmary, lunatic asylum, Albert Institute and free library. University College, for men and women, was opened in 1883, and affiliated to the University of St. Andrews in 1897. It was founded by private munificence, receiving an endowment of £140,000, and has ten professorships. Dundee has several public parks and recreation grounds and a good supply of water. The town has long been celebrated for its textile manufactures, particularly those of the coarser descriptions of linen, and it is now the chief seat of the linen trade in Scotland and of the jute trade in Great Britain, there being a great number of mills and factories engaged in the spinning and weaving of flax, jute, and hemp. Shipbuilding is extensively carried on, and there are large engineering establishments. Another branch of business is the northern seal and whale fishery. Dundee is also famous for its marmalade and other preserves and confectionery. The shipping accommodation includes five large wet-docks, with a connected tidal harbour and graving-docks. The chief foreign trade is with the Baltic and Archangel in the importation of flax and hemp, with Norway, Sweden, and Canada in timber, and with Calcutta in jute. The railway facilities of Dundee were greatly increased in 1878 by the opening of a bridge across the Tay; but on the 28th of Dec., 1879, the bridge was destroyed by a violent storm, when about 100 people in a train in the act of crossing lost their lives. A new bridge, to replace the one destroyed, was opened for traffic in June, 1887; it is a very substantial structure about 2 miles in length. Dundee was made a royal burgh by William the Lion about 1200, was twice in the possession of the English under Edward I, and was as often retaken by Wallace and Bruce. In 1645 it was besieged, taken, and sacked by the Duke of Montrose; and six years afterwards it was stormed by Monk, when a great number of its inhabitants were put to death. Since 1868 the town has returned two members to Parliament. In 1888 it was raised by royal grant to the rank of a city. In 1914 the burgh of Broughty Ferry was annexed to Dundee, increasing its area to 5964 acres. Pop. 176,062; population in 1921, 168,217.

Dundonald, Thomas Cochrane, tenth Earl of, British admiral, was born in Lanarkshire 1775,

died 1860. At the age of eighteen he embarked with his uncle, then Captain, and afterwards Sir Alexander Cochrane, in the *Illind*, of twenty-eight guns, and soon distinguished himself by his daring and gallantry. In 1800 he was appointed to the *Speedy* sloop-of-war of fourteen guns, and in the course of thirteen months captured over fifty vessels, but was at last captured himself. In 1805, while in command of the *Pallas* frigate, he took some rich prizes, and for the next four years in the *Impérieuse* performed remarkable exploits in cutting out vessels, storming batteries, and destroying signals. On his return to England he entered Parliament, and by his attacks on the abuses of the naval administration made himself obnoxious to the authorities. He gave further offence by charging Lord Gambier, his superior officer, with neglect of duty (which was true); by denouncing the abuses of the prize-court, and the treatment of the prisoners of war. His enemies succeeded in 1814 in convicting him on a charge—since proved to be false—of originating a rumour, for speculative purposes, that Napoleon had abdicated. He was expelled from Parliament, ignominiously ejected from the Order of the Bath, imprisoned for a year, and fined £1000. The electors of Westminster immediately paid his fine and re-elected him, but he had to remain in prison till the expiration of his sentence. In 1818 he took service in the Chilean navy, his exploits greatly aiding the national independence of that country, as well as soon after of Brazil. In 1832 he was restored to his rank in the British navy. In 1831, by the death of his father, he had succeeded to the title of Earl of Dundonald; in 1841 he became vice-admiral of the blue; in 1848 he was appointed commander-in-chief on the North America and West India station; and in 1851 and 1854 respectively he became vice-admiral of the white, and rear-admiral of the United Kingdom. He was reinstated in the Order of the Bath (G.C.B.) on 25th May, 1847. He did much to promote the adoption of steam and the screw propeller in war-ships. He wrote an autobiography, which, though left incomplete, is a most interesting work.—Cf. J. B. Atlay, *The Trial of Lord Cochrane before Lord Ellenborough*.

Dunedin (dun-ē'din), capital of the provincial district of Otago, New Zealand, and the most important commercial town in the colony, stands at the upper extremity of an arm of the sea, about 9 miles from its port, Port Chalmers, with which it is connected by railway. Though founded in 1848, its more rapid progress dates only from 1861, when extensive gold-fields discovered in Otago attracted a large influx of population. There are many handsome buildings, both public and private: the municipal buildings, the post office, hospital, lunatic asylum,

Government offices, the university, high schools (boys' and girls'), the new museum, several banks (especially the Bank of New Zealand), the atheneum and mechanics' institute, the freemasons' hall, and two theatres. Wool is the staple export. Several woollen and other manufactories are now in existence. There is a regular line of steamers between this port and Melbourne, and communication is frequent with all parts of New Zealand. Through the opening of the new Victoria Channel from Port Chalmers vessels drawing 16 feet can now ascend to Dunedin at low water. Pop. 68,716.

**Dunes**, low hills of sand accumulated on the sea-coasts of Holland, Britain, Spain, and other countries, in some places encroaching on and covering what once was cultivated land, but in others serving as a natural barrier to protect the country from the destructive encroachments of the sea.

**Dunfermline**, a royal and police burgh of Scotland, county of Fife, 3 miles N. of the Firth of Forth, and 13 miles north-west of Edinburgh. The streets though narrow are well built. Dunfermline was early a favourite residence of the kings of Scotland, and at it were born David II, James I, Charles I, and his sister Elizabeth. The Benedictine abbey founded by Malcolm Canmore (1070) is now represented chiefly by the Abbey Church, in which are the remains of Queen Margaret and Canmore, Alexander I and his Queen, David I, Malcolm IV, and Robert Bruce. Dunfermline was made a royal burgh in 1588. The town has greatly benefited through the munificence of the late Andrew Carnegie, a native, who, besides other benefactions, settled on it the sum of £500,000. In the manufacture of table-linen it is unrivalled by any town in the kingdom. There are collieries adjacent. The Dunfermline burghs return one member to Parliament. Pop. 28,103.

**Dungan'non**, a town of Ireland, County Tyrone, 35 miles west by south of Belfast. It has manufactures of linen and earthenware. Till 1885 it returned a member to the House of Commons. Pop. 3880.

**Dungarpur** (dōn-gar-pōr'), an Indian native state in Rājputāna; area, 1000 sq. miles; pop. 153,381.—*Dungarpur* is also the name of the chief town and residence of the Maharawal of the state.

**Dungar'van**, a seaport of Ireland, County Waterford, on the Bay of Dungarvan, much resorted to for sea-bathing. The harbour is shallow, and the trade depends almost entirely on agricultural produce. Till 1885 it returned a member to Parliament. Pop. 4077.

**Dung Beetle**, a name applied to a large number of lamellicorn beetles (in which the antennæ terminate usually in lateral leaflets)

from their habit of burying their eggs in dung. The *Geotrupes stercorarius*, 'dor' or 'shard-borne' beetle, and the *Scarabæus sacer*, or sacred beetle of the Egyptians, are examples.

**Dungeness** (dunj-ness'), a low headland on the S. coast of Kent, 102 miles S.E. of Rye; has a lighthouse with fixed light.

**Dunkeld**, a small town of Scotland, on the Tay, about 14 miles north by west of Perth; pop. 613. It is a very ancient place, and from 850, when Kenneth I removed the remains of St. Columba from Iona to a church which he had built here, became the metropolitan see of Scotland, till supplanted by St. Andrews. The choir of the ancient cathedral is still used as the parish church. Near it is Dunkeld House, the seat of the Duke of Atholl, the grounds of which are the finest and most extensive in Scotland.

**Dunkers**, or **Tunkers**, also called **Dippers**, a religious sect in America, founded by Conrad Peysel, a German, in 1724, and which takes its name from the Ger. *tunken*, to dip, from their mode of baptizing converts. They reject infant baptism; use great plainness of dress and language; refuse to take oaths or to fight; and anoint the sick with oil in order to hasten their recovery, depending on this unction and prayer, and rejecting the use of medicine. Every brother is allowed to speak in the congregation, and their best speaker is usually set apart as their minister.

**Dunkirk** (Fr. *Dunkerque*), a seaport town, France, department of Nord, at the entrance of the Straits of Dover, surrounded by walls, and otherwise defended by forts and outworks. It has several fine churches, a college, a public library, and a gallery of paintings; manufactures of earthenware, leather, soap, starch, ropes; sugar-refineries, breweries, and distilleries, and a large trade. In 1658 Dunkirk was given up to the English by Turenne, and continued with them till 1662, when Charles II sold it to Louis XIV. It is one of the chief French torpedo stations, and during the European War was a British base and frequently bombed by the enemy. Pop. 38,891.

**Dun'lin**, a British bird (*Tringa alpina*), a species of sandpiper, occurring in vast flocks along sandy shores. It is about 8 inches in length from the point of the bill to the extremity of the tail, and its plumage undergoes marked variations in summer and winter, the back passing from black with reddish edges to each feather, to an ashen grey, and the breast from mottled black to pure white. During the winter it migrates to Asia, Africa, the Canaries, West Indies, and California.

**Dunmow**, Great and Little, two villages, England, county of Essex. The latter is remarkable for the ancient custom, revived in



1855, of giving a fitch of bacon to any couple who, a year and a day after their marriage, could swear that they had neither quarrelled nor repented. The prize, instituted in 1244 by Robert de Fitzwalter, was first claimed in 1445.

**Dun'nage**, faggots, boughs, or loose wood laid in the hold of a ship to raise heavy goods above the bottom to prevent injury from water; also loose articles wedged between parts of the cargo to hold them steady.

**Dunne**, Finley Peter, American humorist, born in Chicago in 1867. After serving as reporter on various papers, he became editor of the *Evening Journal* (1897-1900). Dunne first attracted attention by a series of sketches in the *Times-Herald*, where he humorously commented upon all sorts of subjects in the name of one Martin Dooley, publican of Archey Road. His works include: *Mr. Dooley in Peace and War* (1898), *Mr. Dooley's Philosophy* (1900), *Observations by Mr. Dooley* (1902), and *Mr. Dooley Says* (1910).

**Dunnet Head**, a bold rock promontory in Caithness, with sandstone cliffs 100 to 300 feet high, the most northerly point of the mainland of Scotland, crowned by a lighthouse visible at a distance of 25 miles.

**Dunnot'tar Castle**, an extensive ruin on the coast of Kincardineshire, Scotland, on a precipitous rock rising from the sea. It dates from the close of the fourteenth century, and was long the stronghold of the Keiths, earls marischal. During the Commonwealth this castle was selected for the preservation of the Scottish regalia; and in 1685 it was used as a State prison for Covenanters. It was dismantled in 1720.

**Dunois** (dû-nwä), Jean, Count of Orleans and of Longueville; a French hero, natural son of Louis, Duke of Orleans, born 1402, died 1468. Dunois made the name 'Bastard of Orleans' illustrious by his military exploits. He began his career with the defeat of Warwick and Suffolk, whom he pursued to Paris. Being besieged by the English, he defended Orleans until relieved by the Maid of Orleans. In 1450 he had completely freed France from the English, and was rewarded by the title of 'deliverer of his country', the county of Longueville, and the dignity of High Chamberlain of France.

**Dunoon**, a town, police burgh, and watering-place of Scotland, in Argyllshire, on the shore of the Firth of Clyde, 27 miles by river from Glasgow. It extends for about 3 miles s.s.w. from the Holy Loch, and consists of Hunter's Quay to the n., Kinn and Dunoon proper to the s.; each with its separate steamboat pier. On a green rocky knoll are remains of the castle of Dunoon, once a residence of the family of Argyll. Pop. 9860.

**Duns**, John, commonly called *Duns Scotus*,

an eminent scholastic divine, born 1265 or 1274, but whether in England, Scotland, or Ireland is uncertain. He was admitted when young into an institution belonging to the Franciscan friars at Newcastle, whence he was sent to Merton College, Oxford. In 1801 he was appointed divinity professor at Oxford, and the fame of his learning and talents drew crowds of scholars from all parts. In 1304 he went to Paris, and was appointed professor and regent in the theological schools, in which situation he acquired the title of *Doctor Subtilis*, 'the subtle doctor'. He opposed Thomas Aquinas on the subject of grace and free-will; and hence the *Scotists* are opposed to the *Thomists*. Duns Scotus was the apostle of *realism*, which was opposed to the systems of *nominalism* and *conceptualism* promulgated by the other sections into which the schoolmen were divided. He died, it is said, at Cologne in 1308, leaving behind him numerous works. He was a genuine scholastic philosopher, who worked out ideas taken from Aristotle, St. Augustine, and the preceding scholastics.—**BIBLIOGRAPHY:** W. J. Townsend, *The Great Schoolmen*; C. R. Hagenbach, *History of Doctrines*; E. Pluzanski, *Essai sur la philosophie de Duns Scot*; and article in *Dictionary of National Biography*.

**Duns**, or **Dunse** (dunz, duns), police burgh and county town of Berwickshire, Scotland, on the Whitadder; has manufactures of linen, and paper-mills. Pop. 3040. On Duns Law (700 feet) are traces of a camp formed by Leslie's Covenanters in 1639.

**Dunsin'ane**, a hill in Scotland, one of the Sidlaws, 1012 feet high, about 7 miles n.e. of Perth, with vestiges of a hill-fort locally called Macbeth's Castle, and immortalized by Shakespeare in *Macbeth*.

**Dun'stable**, a town, England, county of Bedford, 32 miles north-west of London. It was an important Roman station, and had a palace and a priory founded by Henry I in 1131. Part of the latter is used as the parish church. It has a grammar school, founded in 1715. Dunstable is famous for its manufactures of straw-plait. Pop. 8057.

**Dun'stan, St.**, an English archbishop and statesman, was born at Glastonbury in 925, died at Canterbury 988. As a youth he was remarkable for his learning and his skill in music, painting, carving, and working in metals. He entered the Benedictine order, became an anchorite at Glastonbury, and in 945 was made abbot by King Edmund. After the death of Edmund, Edred, the next king, made him his Prime Minister and principal director in civil and ecclesiastical affairs. In the reign of Edwy he was banished, but was recalled by Edgar, and made Archbishop of Canterbury. He was again



deprived of power on the accession of Ethelred in 978, and devoted the last years of his life to his diocese and the literary and artistic pursuits of his earlier days. He did much to improve education and to raise the standing and character of the priesthood. The old biographies of him have all a large legendary element.—Cf. W. Stubbs (editor), *Memorials of St. Dunstan* (Rolls Series, 1874).

**Duodecimal System**, in numeration, a system of numbers the scale of which is twelve. *Duodecimals* is a term applied to an arithmetical method of ascertaining the number of square feet, &c., in a rectangular area or surface, whose sides are given in feet, inches, and lines. The method is similar to that of ordinary decimals, the scale being twelve instead of ten.

**Duodecimo** (often contracted *12mo*) is that form of volume in which each leaf forms a twelfth part of the sheet.

**Duode'num** (Lat. *duodeni*, by twelves), the commencement of the intestinal canal, the first of the smaller intestines, so called because its length is about twelve fingers' breadth.

**Dupanloup** (dù-pän-lô), Félix Antoine Philibert, French prelate, born at St. Félix, in Savoy, 1802; became a French subject by naturalization in 1838; died at Paris 1878. He was ordained in 1825, appointed professor of theology at the Sorbonne in 1841, and Bishop of Orleans in 1849. From that time he took a prominent part in all the political and religious discussions in France. He belonged to the Gallican party, but submitted to the decisions of the council of the Vatican; and was a strenuous advocate of free education. He wrote: *La Pacification Religieuse*, *De l'éducation*, and *De la haute éducation*.

**Dupleix** (dù-plä), Joseph, a French leader in India, born 1697, died 1763. He accumulated a fortune by commercial operations in India, and in 1742 was appointed Governor of Pondicherry for the French East India Company. He formed the project of founding a French Empire in India, and soon made himself master of the Carnatic partly by conquest and partly by political intrigue. He was opposed by Clive, and a long string of British successes caused the complete overthrow of all his plans. Recalled in 1753, he died in want and obscurity in Paris.

**Dupont** (dù-pôn), Pierre, French poet and song-writer, born at Lyons 1821, died at St. Étienne (Loire) 1870. He was educated by his godfather, a priest, and began to write and compose songs at an early age. After issuing a volume of poems in 1844, he went to Paris and obtained a place in the office of the secretary of the Institute. Some of his songs, such as *Song of Bread and Song of the Workers*, had a Socialistic ring which proved obnoxious to the Government which came into power in Dec., 1852. He was

arrested, imprisoned, and condemned to be banished for seven years; but his release was soon procured. His poems have been collected under the titles *Cahiers de Chansons*, *La Muse Populaire*, *Chants et Chansons*, *Poésie et Musique*, and *Études Littéraires*.

**Dupont de Nemours** (dù-pôn de nè-môr), Pierre Samuel, French political economist, born at Paris, Dec., 1739; died in America 1817. He early gained a reputation for his writings on commerce, and his exposition of the theories of the physiocrats, and was employed by Turgot and Vergennes in the public service. During the ministry of Calonne he became Councillor of State, and in 1787 was secretary to the Assembly of the Notables. He was twice president of the National Assembly. During the Revolution he opposed the extreme republicans, and narrowly escaped the guillotine at the downfall of Robespierre. From 1798 to 1802 he was in America, and on his return to France he refused all public office. He finally returned to America in 1815. Among his writings are: *Philosophie de l'Univers*, *Vie de Turgot*, and a translation of Ariosto.

**Düppel** (düp'l), a fortified village in Schleswig-Holstein, on the coast of the Little Belt. The place is of considerable strategical importance, and has been the scene of some severe struggles between the Danes, to whom it originally belonged, and the Germans. It was captured by the Prussians in 1864, but restored to Denmark by the plebiscite taken in 1920.

**Dupuy**, Charles Alexander, French statesman, born at Le Puy, Haute-Loire, in 1851. Educated at the Lycée of Le Puy and the Lycée Charlemagne in Paris, he was professor of philosophy at the colleges of Nantes and Aurillac, and afterwards vice-rector of the Corsican College at Ajaccio. He entered the Chamber of Deputies in 1885, was Minister of Public Instruction in 1889, and succeeded Ribot as Premier in 1893, but resigned and became President of the Chamber of Deputies. He was again Premier from 1894 to 1895, and from 1898 to 1899, and was elected to the Senate in 1900. He was Minister of Labour from 1912 to 1914. He died in July, 1923.

**Dupuytren** (dù-pü-i-trän), Guillaume, Baron, French surgeon and anatomist, born in 1777, died at Paris 1835. In 1812 he became professor of surgery, and in 1815 first surgeon to the Hôtel Dieu, Paris. In 1823 he was appointed first physician to Louis XVIII, and retained the same situation under Charles X. He was considered the first French surgeon of his day, made important discoveries in morbid anatomy, and invented several useful surgical instruments.

**Duquesne** (dù-kän), Abraham, French admiral, born 1610, died 1688. In his seventeenth year he was in the sea-fight off Rochelle, and

distinguished himself during and after the year 1637 in the war against Spain. In 1647 he commanded the expedition against Naples. In the Sicilian War he thrice defeated the combined fleets of Holland and Spain, under the renowned De Ruyter. After he had reduced Algiers and Genoa, Louis XIV conferred upon him the fine estate of Bouchet, and made it a marquise, with the title of Duquesne. He was a Protestant, and the only person exempted from the banishment of his sect, occasioned by the repeal of the Edict of Nantes.

**Dura'men**, the name given by botanists to the central wood or heart-wood in a tree trunk. It is harder than the newer wood that surrounds it, and is often dark-coloured from being impregnated with tannin and other antiseptic substances.

**Durance** (dû-râns), a river of France, which rises in the Cottian Alps, and, after a course of about 180 miles, joins the Rhone about 4 miles below Avignon. Marseilles is supplied with water from the Durance.

**Duran'go**, a town in Mexico, capital of the state of Durango, about 500 miles N.W. of Mexico, on an elevation 6845 feet above the sea. It is well built, has a cathedral, a mint, manufactures of cotton and woollen goods and leather. Pop. 34,085.—The state (area, 42,272 sq. miles) is partly mountainous and unproductive, but has valuable gold-, silver-, and iron-mines, and also fertile tracts. Pop. 436,147 (1910); estimated pop. in 1919, 509,585.

**Durante** (do-rân'tà), Francesco, Italian musician, born 1684, died 1755. He attained a high degree of eminence in vocal church music, and he trained the most celebrated musical masters of the eighteenth century in Naples—Pergolesi, Sacchini, Piccini, Guglielmi, and Jomelli.

**Durazzo** (dô-rüt'sô; ancient Dyrrhachium, or Epidamnus), a seaport of Albania, on the Adriatic, 50 miles south by west of Scutari. It is fortified, and has a good harbour. For four centuries the town remained under Turkish rule and lost all importance, but in 1912, during the Balkan War, it came again into prominence. It was occupied by the Serbians on 28th Nov., 1912, and in 1913 was incorporated in the newly created Principality of Albania. During the European War Durazzo was captured by the Austrians in Feb., 1916, but was reoccupied by the Italians on 14th Oct., 1918. Pop. 5000.

**Dur'ban**, chief port of Natal, on a land-locked bay (Port Natal). It is well laid out, has a fine town hall, handsome churches, post office, hospital, electric tramways, and parks and gardens, and is connected by railway with Maritzburg and the interior. The harbour now admits large vessels. Founded in 1824, it was named after a governor of the Cape. Pop. 48,475.

**Durbar** (dûr-bâr'; Pers. *dar*, door, and *bar*, court, admittance), a term signifying the court, council-chamber, or audience-room in the palaces of the native princes of India; hence, a general reception by a ruler in British India or by any officer of rank. Durbars were held on a ridge at Delhi on the proclamation of Queen Victoria (1877), of King Edward VII (1903), and of King George V (1911).

**Düren** (dû'ren), a town in the Rhine province, on the right bank of the Roer, 16 miles E. by N. of Aix-la-Chapelle. It has important manufactures of woollens, paper, leather, rails, and hardware, and an extensive trade. Pop. 32,511.

**Dürer** (dû'rër), Albrecht, German painter, designer, sculptor, and engraver on wood and metal, born at Nürnberg 1471, died there 1528. His father was a skilful goldsmith of Hungary. In 1486 he left his father's trade and became an apprentice of Michael Wohlgemuth, then the best painter in Nürnberg. Having finished his studies, he entered upon his 'wanderjahre', the usual course of travels of a German youth. On his return to Nürnberg he married Agnes, the daughter of Hans Frey, a mechanic, who has been falsely accused for centuries of embittering his life and bringing him to his grave. In 1505 he went to Venice to improve himself in his art. His abilities excited envy and admiration. He painted the *Martyrdom of Bartholomew* for St. Mark's church, which painting was purchased by the Emperor Rudolph and removed to Prague. He also travelled to Bologna, to improve his knowledge of perspective. On his return to Nürnberg his fame spread far and wide. Maximilian I appointed him his court-painter, and Charles V confirmed him in this office. All the artists and learned men of his time honoured and loved him, and for many years he was one of the chief burghers of his native town. Profound application and great facility in the mechanical part of his art were the characteristics of Dürer, and enabled him to exert a great influence on German art. He was the first in Germany who taught the rules of perspective, and of the proportions of the human figure. He not only made use of the burin, like his predecessors, but was also among the first to practise etching. He also invented the method of printing woodcuts in two colours. Among his masterpieces in painting are a *Crucifixion*, *Adam and Eve*, an *Adoration of the Magi*, and portraits of Raphael, Erasmus, and Melancthon, who were his friends. Among his best engravings on copper are his *Fortune*, *Melancholy*, *Adam and Eve in Paradise*, *St. Hubert*, *St. Jerome*, and *The Smaller Passion*, in sixteen plates. Among his best engravings on wood are *The Greater Passion* (so called), in fifteen plates; *The Smaller Passion*, with the frontispiece, thirty-

seven pieces; *The Revelation of St. John*, with the frontispiece, fifteen plates; *The Life of Mary*, two prints, with the frontispiece. Dürer has also much merit as a writer, and published works on *Human Proportion*, *Fortification*, and the *Use of the Compass and Square*.—BIBLIOGRAPHY: Thausing, *Dürer, Geschichte seines Lebens und seiner Kunst* (2 vols.; English translation by F. A. Eaton); L. Cust, *Albrecht Dürer: a Study of his Life and Works*; F. Nüchter, *Life and Selection from Works*.

Du'ress (Lat. *duritia*, severity, from *durus*, hard), in law, restraint or compulsion, is of two kinds: *duress of imprisonment*, which is imprisonment or restraint of personal liberty; and *duress* by menaces or threats (*per minas*), when a person is threatened with loss of life, or with some kind of injury. An act done under duress is voidable or excusable.

D'Urfey (dur'fi), Thomas, an English poet and wit, the grandson of a French Protestant refugee, was born at Exeter in 1653, and died in 1723. He abandoned law for literature, and wrote a large number of comedies of a licentious character. His bombastic tragedy *The Siege of Memphis* appeared in 1676. D'Urfey's name is now principally remembered in connection with his *Pills to Purge Melancholy*, a collection of songs and ballads, partly his own, and many of them coarse or licentious. His society was generally courted by the witty, and he enjoyed the favour of four successive monarchs.

Durgā (dur'gā), a Hindu divinity, one of the names given to the consort of Siva. She is

and in others, the trident, discus, axe, club, and shield. A great festival in her honour, the *Durga puja*, is celebrated annually, lasting for ten days.

Durham, Simeon of, English chronicler of the twelfth century; wrote *Annals of England to the Reign of Henry I*, particularly valuable for events connected with the north of England. They were continued by John of Hexham.

Durham (du'rain), an ancient city, capital of the county of the same name, on the River Wear, which is crossed here by four bridges, 14 miles s. of Newcastle. The principal public buildings are the ancient castle—now appropriated to the uses of the university—the cathedral and other churches, the town hall, county prison, and grammar-school. The educational institutions comprise the university, opened in 1833, the grammar-school, a training-school for school-mistresses, and other schools. There are manufactures of carpeting and mustard. The cathedral occupies a height overlooking the Wear. The larger portion of it is Norman in style, with insertions in all the English styles. Three magnificent and elaborately ornamental towers spring up from the body of the building, one from the centre 212 feet high, and two together from the west end each 143 feet high; the entire length is 420 feet. It was founded by William de St. Carilef, assisted by Malcolm, King of Scotland, in 1093. A parliamentary borough until 1918, Durham returned two members to the House of Commons from 1673 to 1885, and one member from 1885 to 1918. Pop. 17,500.

Durham Book, a Latin text of the gospels written by Bishop Eadfrith of Lindisfarne, with an interlinear Saxon gloss, finished in the year 720; now in the British Museum.

Durham, County of, a county on the n.e. coast of England, having on the e. the North Sea, on the n. Northumberland, from which it is divided by the Rivers Tyne and Derwent, Cumberland on the w., and Yorkshire on the s., the River Tees parting the two counties. Its area is 647,592 acres, of which two-thirds are under cultivation. The western portion of the county is hilly, enclosing fertile valleys, the eastern portion is more level, and the centre contains extensive coal-fields. Durham is the chief coal county in England, and also produces fire-clay. The chief crops are wheat, oats, turnips, and potatoes. The cattle are esteemed both for the dairy and for fattening. In connection with the commerce of the county may be noticed its foundries, ironworks, potteries, glass-houses, iron-shipbuilding, engine and machine works, and chemical works. For parliamentary purposes it is divided into eleven divisions, each of which sends one member to the House of Commons. It was formerly one of



Durga

generally represented with ten arms. In one hand she holds a spear, with which she is piercing Mahisha, the chief of the demons, the killing of whom was her most famous exploit; in another a sword; in a third the hair of the demon chief;

the three counties called counties *palatine*. The chief towns besides Durham are Sunderland, Gateshead, South Shields, Stockton, Darlington, and Hartlepool. Pop. 1,389,860.—(Cf. *Victoria History of the County of Durham*).

Durham University, founded in 1832, opened in 1833, incorporated by royal charter in 1837. It is connected with the bishopric of Durham, the office of warden being annexed to the deanery of Durham, and a canonry in the cathedral being annexed to each of the professors of divinity and classical literature. There are also professors of mathematics, Hebrew, medicine, &c. The students mostly reside within the university buildings, but in 1870 a regulation was passed dispensing with the necessity of residing in any college, hall, or house connected with the university in order to be admitted as a member. The management of the university is entrusted, under the Bishop of Durham as visitor, to the dean and chapter of the cathedral as governors, and to the warden, senate, and convocation, the last including all persons regularly admitted since the opening of the university to the degrees of Doctor in Divinity, Civil Law, and Medicine, and to the degree of Master of Arts. The academical year is divided into three terms—Michaelmas, Epiphany, and Easter. For the degree of B.A., or a licence in theology, a residence of two years (of six months each) is necessary. The M.A. degree may be obtained by a graduate who is of the standing of nine terms since taking his degree of B.A. Armstrong College, founded in 1874, and the College of Medicine, both at Newcastle-on-Tyne, form part of the University of Durham.

Durlan, or Durlon (*Durio zibethinus*), a large and lofty tree growing in the Malayan Archipelago. The largish flowers, of a yellow-green colour, are produced on the stem or main branches, and are followed by the large fetid fruit, which is of the size of a man's head, and is a favourite food of the natives during the time (May and June) when it is in season. There is usually a second crop in November. The smell is offensive, like putrid animal matter, but with this is associated the most delicious flavour, which places it, notwithstanding the odour, in the opinion of many, in the foremost place among tropical fruits.

Dürkheim (dûrk'hîm), an old town in Rhenish Bavaria (the Palatinate), 14 miles w.s.w. of Mannheim, well known for its mineral water. The town was destroyed by the French in 1689. Pop. 6523.

Dürkheim, Émile, French philosopher and sociologist, born at Les Vosges 15th April, 1858, died in Paris 15th Nov., 1917. Educated at the École Normale Supérieure, he travelled in Germany, where he studied social conditions.

In 1887 he founded the first French chair in sociology at the University of Bordeaux. Dürkheim's merit consists in having separated sociology from mere psychology, and in having made a distinction between individual mental phenomena and Folk-psychology. In 1898 he founded and published annually *L'Année Sociologique*. His other works include: *De la division du travail social* (1898); *Les règles de la méthode sociologique* (1894); *Le Suicide* (1897); *Les formes élémentaires de la vie religieuse; Sociologie et sciences sociales* (1910); *Le système totémique en Australie* (1912); *La Sociologie* (in *La Science Française*, 1915); *Qui a voulu la guerre?*; *Les*



Durian and Section of Fruit

*Origines de la guerre, d'après les documents diplomatiques* (1915).

Durlach (dûrlâh), a town in Baden, 4 miles E.S.E. of Carlsruhe, at the foot of the Turmberg, with manufactures of machinery, chemicals, and leather. Pop. 13,896.

Durmast, a species of oak, *Quercus sessiliflora*, or according to some, *Q. pubescens*, so closely allied to the common oak (*Q. robur*) as to be reckoned only a variety of it. Its wood is, however, darker, heavier, and more elastic, less easy to split, not so easy to break, yet not so difficult to bend. It is highly valued, therefore, by the builder and cabinet-maker.

Duroc (dû-rok), Michel Géraud Christophe, Duke of Friuli, a distinguished general under Bonaparte, born at Pont-à-Mousson in 1772, killed, 1813, at the battle of Bautzen. He served as aide-de-camp to Napoleon in the Italian and Egyptian campaigns. In 1805 he was made grand-marshal of the palace; and was frequently employed in diplomatic missions, though he still

took his full share in the wars of France till the time of his death. He was a great favourite of Napoleon, and was killed by his side.

**Durra**, or **Dhurra**, Indian millet, the seed of *Sorghum vulgare*, after wheat the chief cereal crop of the Mediterranean region, and largely used in those countries by the labouring classes for food. Varieties are grown in many parts of Africa, one of them being known as Kaffir corn.

**Dürrenstein** (dûr'en-stîn), a village in Lower Austria, on the Danube, 41 miles west by north of Vienna. Here are the ruins of the castle in which Leopold, Duke of Austria, imprisoned Richard Cœur-de-Lion on his return from Palestine, 1192.

**Dusuy** (dû-rû-ê), Victor, French historian and educationist, born at Paris 1811, died in 1894. His father was a workman in the Gobelins tapestry works, and the boy did not begin his education until he was grown up. He was admitted to the École Normale Supérieure in 1830, graduated in 1833, and was appointed successively teacher of history in the Lycée Henri IV, then at the Normal School and the Polytechnic School, inspector of the Academy of Paris, inspector-general of secondary education, and Minister of Public Instruction (1863-9). He is author of *Géographie Politique de la République Romaine et de l'Empire*, *Géographie Historique du Moyen Age*, *Histoire Romaine*, *Histoire de France*, *Histoire Grecque*, *Histoire Populaire Contemporaine*, &c. Some of these are simply school-books, but his *Histoire des Romains* (translated into English) and his *Histoire de la Grèce Ancienne* (translated into English) are extensive and important works, the former especially.

**Duse**, Eleonora, Italian actress, born at Vigevano, near Venice, in 1859. At the age of thirteen she made her first appearance on the stage, and in 1883 she acted at Rome, when she was recognized as one of the greatest Italian, and even one of the greatest living actresses. From that time her career was one of uninterrupted success, and she gained a world-wide reputation. Duse is one of the dramatic artists who discard the customary mannerisms of the stage, and all that is conventional but unreal in modern acting. Some of d'Annunzio's best plays were specially written for her. Among her most remarkable impersonations are those of Francesca da Rimini, Marguerite Gautier in *La Dame aux Camélias*, Magda, La Tosca, Paula in *The Second Mrs. Tanqueray*, and Nora in Ibsen's *A Doll's House*. She appeared for the first time in London in 1897. She died in 1924.

**Düsseldorf** (dûs'sel-dorf), a town of Germany, in the Rhine province, beautifully situated among villas and gardens on the right bank of the Rhine, 22 miles N.W. of Cologne, one of the handsomest towns in the valley of the Rhine. It is

a great focus of railway and steamboat communication, and has a number of handsome public buildings, and several remarkable churches. Among the public institutions particular notice is due to the Academy of Art, founded in 1787, by the Elector Theodore, and afterwards directed by Cornelius, Schadow, and Bendemann. It has the honour of having founded a school of painting, which takes the name of Düsseldorf, and has had a large number of distinguished pupils. The industries embrace iron, machinery, railway plant, cotton, leather, chemicals, and beer, and the trade is large. Pop. 353,723.

**Dust**, solid matter in a fine state of division. Spores of plants, bacteria, &c., are found in the atmosphere, but in general organic particles are numerous only over thickly populated districts. Inorganic particles are derived from various sources. Where the soil is dry, dust is whirled aloft by the winds, this cause giving rise to the great sand-storms of tropical desert regions. Volcanoes in eruption eject large quantities of dust. It is estimated that millions of meteors are encountered by the earth per day. Most of these are excessively minute. They are speedily disintegrated, and generally entirely reduced to dust at high levels. Evaporation is almost always proceeding over seas and oceans, and from foam thrown up and swept along by the winds the dissolved salts are liberated as solid particles. Again vast quantities of dust are produced in the consumption of fuel.

The late Dr. John Aitken, F.R.S., of Falkirk, Stirlingshire, contrived a means of gauging the dust contents of the atmosphere. This consists of a glass box about a centimetre in thickness. Two pieces of wet filter paper inside serve to keep the contained air damp. The bottom of the box is a micrometer plate, divided rectangularly in millimetres. It can be examined from above by a lens. An air-pump can withdraw definite volumes of air as desired. When the air is partially withdrawn, the expansion of the remainder produces cooling. The dust particles form nuclei for condensation of the vapour. They are thus precipitated on the plate, and counted, leaving the air dust-free. A measured quantity of the air to be tested is next drawn in and shaken up. Further operation of the air-pump causes its expansion, and the deposition of its dust particles, which can then be counted. Dr. Aitken found the proportion of dust on Ben Nevis to vary at different times from under 100 particles to over 14,000 per cubic centimetre. Over oceans the numbers were from about 500 on the Indian to 2000 on the Atlantic. But over cities 100,000 per cubic centimetre are frequently present. A puff of cigarette smoke was estimated to contain 4,000,000,000 particles.

Many phenomena are connected with the existence of dust in the atmosphere. As a result of Dr. Aitken's discoveries the belief largely prevailed that the formation of fog, of rain, and other varieties of precipitation, was necessarily dependent on dust particles as nuclei of condensation. Though they certainly function to a preponderating extent, it has been shown that gaseous particles can act similarly, particularly when air is ionized. Dust is the main cause of the scattering of the sun's rays which produces twilight, the blue of the sky, the gorgeous red and golden hues of sunrise and sunset, and the purple lights of advancing dusk. After the great Krakatoun eruptions of 1883, dust was carried in the upper atmosphere several times round the earth, and caused extraordinary colour effects. To a lesser degree similar phenomena followed the West Indian eruptions of 1902. The unusual sunlessness of the summer of 1912 was attributed to dust expelled in the preceding great eruptions at Katmai, Alaska.

**Dutch Clover**, *Trifolium repens*, commonly called white clover, a valuable pasture plant. It has a creeping stem; the leaflets are broad, obovate, with a horse-shoe mark in the centre; the white or pinkish flowers are in a globular head.

**Dutch East Indies**, forming a large and important colonial possession of the Netherlands Government, lie between 6° N. and 11° S., and 95° E. and 141° E. The colony includes Java and Madura, with the 'Outposts', which comprise Sumatra, the south-east and west portions of Borneo, Banca, Billiton, Celebes, the Timor and Riau-Lingga Archipelagos, the Lesser Sunda Islands, and the north and west of New Guinea. The total area is about 735,000 sq. miles; the population of about 47,000,000 is composed of 46,000,000 natives of Malay race, 832,000 Arabs, Chinese, and other Orientals, and some 80,000 whites. The origin of the colony may be traced to the treaty made by the Dutch with the Sultan of Bantam in Sumatra (1505), which was followed by the formation of the Dutch East India Company (1602), the establishment of Batavia (1619) on the ruins of the native town of Jacatra, and the settlement in Sumatra (1677). The Dutch East India Company was dissolved in 1798, since which date the colony has been administered from the Netherlands by a Governor-General, who, assisted by a Council of five members nominated by the queen, has the power to pass laws, subject to the general regulations adopted in 1854. Some of the outlying islands are, however, administered by their native princes under the 'advice' of a Netherlands Resident. Batavia (population about 234,000), a town in the province of the same name on the north-west coast of Java, is the administrative capital and an important centre of trade. Java

and Sumatra, containing about three-fourths of the total population of the colony, are self-supporting as regards food, besides producing for European consumption large quantities of tobacco, tea, coffee, sugar, cinchona, tin, rubber, and copra. The colonial army numbers some 1200 officers and 40,000 men; compulsory service for white men within certain age-limits was adopted in 1918. There is also a small naval force.—**BIBLIOGRAPHY:** Benmielen and Hooyer, *Guide to the Dutch East Indies*; W. Cool, *With the Dutch in the East*; J. M. Brown, *The Dutch East*.

**Dutch Metal**, an alloy containing 84·5–84·7 per cent of copper and 15·5–15·3 per cent of zinc, with a fine golden-yellow colour, ductile, malleable, and tenacious. When beaten out by a process analogous to that for gold-leaf, until the sheets are less than 1/50,000th part of an inch thick, it constitutes Dutch leaf or Dutch foil, and is used as a cheap substitute for gold-leaf for ornamental purposes.

**Dutch Pink**, a bright yellow colour used in distemper, for staining paper-hangings, and for other ordinary purposes. It is composed of chalk or whiting coloured with a decoction of birch leaves, French berries, and alum.

**Dutch Rush**, *Equisetum hyemale*, one of the plants known as horse-tails, with a firm texture and so large an amount of silica in the cuticle that it is employed as the sand-paper for polishing delicate woodwork. The plant is found in marshes and woods in Britain, but for economic use it is imported from Holland, whence its popular name.

**Dutrochet** (dù-tro-shā), René Joachim Henri, a French physiologist, born in Poitou in 1770, died at Paris in 1847. He served for some time as medical attendant to Joseph Bonaparte during the Spanish campaign 1808–9; but afterwards returned to France, and retired to the estate of Châteaurenault, where he devoted himself exclusively to physical and physiological studies. His chief works have been published in a collective form with the title *Mémoires pour servir à l'histoire Anatomique et Physiologique des Végétaux et des Animaux* (1837, 2 vols.).

**Dvina**, Northern, a Russian river formed by the union of two small streams in the government of Vologda. It flows in a north-westerly direction, and falls by four mouths into the White Sea. At Archangel, before it divides, it is 4 miles broad. It is navigable as far as Suchona, and is connected with the Volga and Neva by canal.

**Dvořák** (dvor-shāk'), Anton, a Bohemian musical composer, born in 1841, died in 1904. He studied at the Prague Conservatoire, and composed several operas on national Bohemian subjects, songs, orchestral arrangements of Bohemian dances, several symphonies, a *Stabat*



*Mater*, a cantata (*The Spectre Bride*), and an oratorio (*St. Ludmila*). In 1892 he was director of the New York National Conservatory, and after 1895 he lived in Prague, where he wrote, in 1889, the opera *Der Teufel und die wilde Kätze*.

**Dwarf**, a term applied to any animal or plant greatly below the usual size of its kind, particularly to a human being of small dimensions. Strictly speaking, the term should be used with reference to individuals and not to races. When a whole population consists of people of small stature, the proper term to apply to them is pignies, not dwarfs. Accounts of pigmy tribes have been common from early times, such tribes being located especially in Africa; and it would appear from the accounts of Du Chaillu, Schweinfurth, and other travellers that there are several pigmy tribes throughout this continent. The Obongo, a race of dwarfs, are described as living in woods near the Okanda River, in wretched huts made of branches. Other races are the Mabongo, and the Akka dwarfs of Central Africa (see *Akkas*); and a race exists in the Congo State, not as a distinct community, however, but mixed with other tribes. Individual dwarfs occur in all races, and were formerly a fashionable appendage to the courts of princes and the families of nobles. Jeffery Hudson, the favourite dwarf of Charles I, at the age of thirty is said to have been only 18 inches high, though he afterwards grew to 3 feet 9 inches. Bébé, the celebrated dwarf of Stanislas of Poland, was 33 inches; Wybrand Lolkes, a Dutch dwarf, when sixty years of age was only 27 inches; Charles H. Stratton, 'General Tom Thumb', was 31 inches high at the age of twenty-five; Francis Flynn, 'General Mite', was only 21 inches at sixteen. In most of the extreme cases the dwarfing is the result of some defect in the ductless glands which regulate the normal growth of the body. Stories of dwarfs and brownies are to be found in the folk-lore of many tribes on earth.—**BIBLIOGRAPHY:** E. J. Wood, *Giants and Dwarfs*; E. Tyson, *Philological Essay concerning Pygmies of the Ancients*.

**Dwarfing**, the process of training up trees or shrubs for ornament in houses so as to cause them never to reach more than a very small size, by keeping them in poor soil, giving them little water, pinching off strong shoots, &c. It is much practised among the Chinese and Japanese.

**Dwight** (dwīt), Timothy, American divine, born in Massachusetts 1752, died 1817. His father was Colonel Timothy Dwight, and his mother was a daughter of Jonathan Edwards. He served as chaplain in the revolutionary army, and ultimately became president of Yale College. His *Theology Explained and Defended* (1816) was for long a standard work both in Britain and in America.

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**Dy'aka**, the aborigines of Borneo, chiefly inhabiting the interior of the island. They are a finely formed race, of a yellow complexion, and are described as docile, industrious, and superior to the Malays. The more advanced of them practise agriculture and dwell in neatly-constructed and tolerably comfortable houses. In Sarawak they have made considerable advances in civilization. The practice of head-hunting (hunting their enemies to make trophies of their heads) is practised among them, but has been abolished where European influence prevails.—Cf. Hose and M'Dougall, *The Pagan Tribes of Borneo* (2 vols.).

**Dyaus** (dyous), the god of the sky in the older mythology of the Hindus. His name is etymologically connected with that of the Greek Zeus.

**Dyce** (dls), Alexander, Shakespearean editor, born at Edinburgh 30th June, 1798, died 15th May, 1869. He was educated at Edinburgh and Oxford, but in 1827 settled in London, where most of his life was passed. He first became known by his editions of Collins, Peele, Webster, Marlowe, and Skelton, accompanied by notes and biographies of the authors. His chief work was an edition of Shakespeare in six volumes, with notes (1853-8).

**Dyce**, William, painter, born at Aberdeen in 1806, died near London, 1804. He studied in London and Rome, and practised his art in Edinburgh. In 1840 he became director of the School of Design in London, and in 1844 was appointed professor of fine art in King's College, London. He was elected a Royal Academician in 1848. Amongst his chief works are: *Francesca da Rimini* (1837); *Joash shooting the Arrow of Deliverance* (1844); *King Lear in the Storm* (1851); *Christabel* (1855); *The Good Shepherd* (1856); *The Baptism of Ethelbert*, a large fresco for the Houses of Parliament, and a series of frescoes illustrative of the legends relating to King Arthur, for the same. He also executed for the Prince Consort, at Osborne, the fresco *Neptune giving the Empire of the Sea to Britannia*.

**Dyeing** is the art of colouring textile and other materials in such a way that the colours are not readily removed by the action of light, washing, &c. Like spinning and weaving, it was originally a home industry, as it still is in many places. The natural dyes formerly employed are now largely displaced by dyes derived from coal-tar products, the first discovery of which was made by Perkin in 1856; a few mineral colours are employed in cotton dyeing. Before dyeing, the materials have generally to be cleansed or bleached to get rid of undesirable colouring matters or impurities; and frequently a textile material is subjected to some subsidiary treatment in order to obtain special effects. For example, cotton yarn may be subjected to



the action of strong caustic soda ('mercerizing' process) while in a state of great tension, in order to give it a permanent silky lustre. Dyeing is not only an art, it is also a branch of applied chemistry. One fundamental principle is, that the colouring matter and other necessary substances must be applied in a state of solution, and while in direct contact with the fibre they must be rendered insoluble, so that they are precipitated within or upon the fibre and fixed permanently. The method of effecting this varies greatly, according to the fibre and the colouring matter employed. As a rule, the vegetable and the animal fibres are dyed by very different methods. The affinity of the animal fibres for certain colouring matters is often so great that they are readily dyed by simple immersion in hot colour solutions; but this simple process is not generally sufficient. According to the method of their application in dyeing, the following groups of dye-stuffs may be distinguished: *Acid Dyes*, *Basic Dyes*, *Direct Dyes*, *Developed Dyes*, *Mordant Dyes*, *Vat Dyes*. A dye is *substantive* to a particular fibre when it dyes that fibre directly, and *adjective* when the presence of a third substance known as a *mordant* is necessary.

The *acid dyes* are so called because they are of an acid character and are applied in an acid dye-bath. As a rule, they are only suitable for dyeing the animal fibres, e.g. wool and silk, also leather, horn, feathers, &c., and they are substantive to these materials. The purple vegetable dyestuff *orchil* belongs to this class. The acid dyes derived from coal-tar are very numerous, and yield a great variety of hues—red, orange, yellow, green, blue, violet, brown, and black. The *basic dyes* are so called because their essential constituents, to which they owe their dyeing power, are organic bases. The bases themselves are colourless and too insoluble in water to be of use, hence they are employed in the form of their soluble coloured salts, usually the hydrochlorides of the colour-bases. Their solutions are precipitated by tannic acid, because it combines with the colour-bases to form insoluble tannates. Wool, silk, and animal substances generally have a direct attraction for colour-bases, and hence these fibres are readily dyed by simple immersion in hot aqueous solutions of the basic dyes. Cotton and linen, on the other hand, are not dyed so readily; they need first to be mordanted or impregnated with the *mordant* tannic acid. Most of the colours of this class are fugitive to light, and all but one, viz. *barberry root*, are derived from coal-tar products.

The *direct dyes* are so called because they dye cotton without the aid of any mordanting process. The first of this class derived from coal-tar was *congo red*, discovered in 1884; at present

this group includes a very great variety of fast colours, and forms, indeed, one of the most important and valuable series of dye-stuffs employed. Cotton, linen, and the vegetable fibres generally are dyed in the simplest possible manner by merely boiling them in a solution of the dye-stuff, with or without the addition of a little soap, carbonate or sulphate of soda, &c. Wool and silk are frequently dyed in the same manner as cotton. Very few vegetable dye-stuffs belong to the direct colours, e.g. *Safflower*, *Turmeric*, *Saffron*, *Annatto* (see the articles). They are all fugitive, and are now of little or no importance to the dyer. The coal-tar colours of this class, on the other hand, are extremely numerous. The *developed dyes* are formed *in situ* upon the fibre by the successive application of two or more substances. They include *aniline black*, a permanent black produced by the oxidation of aniline, and the *ice colours*, which are *azo dyes* derived from certain coal-tar products containing nitrogen.

The *mordant dyes* form one of the most important classes of colouring matters, for they include not only most of the vegetable dye-stuffs, e.g. madder, logwood, fustic, &c., but also many valuable fast coal-tar colours, commonly known as the *alizarin dyes*, after their typical representative, alizarin. These mordant dyes have by themselves very little colouring power, as a rule, and if employed alone in dyeing give little or no result. If applied, however, in conjunction with metallic salts, notably those of chromium, aluminium, iron, tin, and copper, they each yield a variety of colours, according to the metallic salt employed. In employing them two distinct operations are usually involved: first, that of applying the metallic salt or *mordant*, called the *mordanting process*; and second, that of *dyeing proper*, in which the mordanted material is boiled in a solution or decoction of the dye-stuff. During the dyeing operation the colouring principle of the dye-stuff combines with the metallic salt already upon the material, and the colour is thus produced and fixed upon the fibre. The method of mordanting varies with the fibre and the metallic salt employed. The vegetable dye-stuffs of this class include *Madder*, *Sapanwood*, *Camwood*, *Barwood*, *Old Fustic*, *Young Fustic*, *Quercitron Bark*, *Persian Berries*, *Weld*, *Logwood* (see these separate articles). *Madder* was formerly the most important and highly valued of the dye-stuffs of this class; being especially employed to produce the fine 'Turkey-red' dye; but it is now entirely superseded by the coal-tar colour alizarin. Similarly, the employment of *cochineal* (an insect dye) has also greatly diminished through the introduction of the cheaper colours. *Camwood* and *barwood* are almost entirely used in wool-dyeing, either in

conjunction with the indigo-vat or for the purpose of dyeing various shades of brown. *Old fustic* is the most important of the yellow mordant dye-stuffs, and the colours are fast although not very brilliant. *Quercitron bark* is an excellent dye-stuff employed by wool-dyers for the production of bright orange and yellow colours. *Persian berries* and *weld*, a species of wild mignonette, are both excellent dye-stuffs, but their employment is now limited. *Logwood* is largely employed by wool, silk, and cotton dyers for dyeing black and dark-blues, which, although fast to washing, are only moderately so towards light. The important vegetable dye *catechu* (q.v.) is used in dyeing cotton and wool brown. On wool, catechu yields *khaki* browns in single bath by using copper sulphate as the mordant. On silk, it is largely employed for weighting purposes in the process of dyeing black. Although dyewoods are still much employed, they are being steadily replaced by coal-tar colours. The *vat dyes* are insoluble in water, but yield reduction products which are soluble in aqueous alkali, and can be readily reoxidized to the dye-stuff. In this class may be included the *sulphur dyes*, substances of uncertain composition obtained by fusing certain compounds containing nitrogen with sulphur and sodium sulphide, which are now extensively and increasingly employed, especially as direct dyes for cotton. *Indigo*, a typical vat dye, is prepared both artificially and from natural sources. It is a dark-blue powder quite insoluble in water, but when reduced it yields *indigo-white* which dissolves in aqueous alkali, the solution thus obtained being called an *indigo-vat*. Cotton, wool, or silk steeped for some time in the clear yellow solution of such a vat, and then exposed to the oxidizing influence of the air, is dyed a permanent blue. The indigo-white absorbed by the fibre loses its acquired hydrogen, and thus insoluble indigo-blue is regenerated within and upon the fibre.

In the classification adopted above, the following *mineral colours* employed in cotton dyeing belong to the group of developed dyes, since they are formed on the fibre: *chrome yellow*, obtained by immersing cotton successively in solutions of acetate of lead and bichromate of potash; *iron buff* (oxide of iron), produced by the successive application of sulphate of iron and carbonate of soda; *Prussian blue*, developed by passing the buff-dyed cotton through an acidified solution of potassium ferrocyanide; *manganese brown* (oxide of manganese), deposited similarly to iron buff. The mineral colours are very useful for certain purposes, and are very fast to light. — BIBLIOGRAPHY: Crookes, *A Practical Handbook of Dyeing and Calico-printing*; W. P. Dreaper, *Chemistry and Physics of Dyeing*; Knecht, Rawson, and Loewenthal,

*Manual of Dyeing*; Rawson, Gardner, and Laycock, *A Dictionary of Dyes, Mordants, &c.*

Dyer, John, English poet, born in Carmarthen-shire about 1700, died in 1758. Educated at Westminster School, he became a painter, but, not succeeding in that vocation, took orders and was appointed to a small living. In 1727 he published his poem of *Grongar Hill*, in 1740 *The Ruins of Rome*, and in 1757 *The Fleece*, a didactic poem in five books.

Dyer's-broom, a European and now also N. American shrub (*Genista tinctoria*), formerly used with woad for dyeing green.

Dyer's-weed, *Reseda Luteola*, a British plant of the same genus as mignonette, otherwise called *Yellow-weed*, *Weld*, or *Woad*, nat. ord. *Resedaceæ*. This plant grows in waste ground; it affords a beautiful yellow dye, and is cultivated for that purpose. — *Dyer's Greenweed* is *Genista tinctoria*.

Dying Declaration, a deposition made by one who is in prospect of death. Such declarations are as a general rule admissible as evidence only in criminal and not in civil cases, and must be made, according to English, though not Scottish law, in the full consciousness of the danger of death.

Dynamics is the science which deals with the laws of force in their relation to matter at rest or in motion, and as such it is differentiated from *kinematics*, which considers motion mathematically, and apart from the forces producing it. Dynamics is divided into two great branches: *statics*, which treats of solid bodies at rest under the action of forces; and *kinetics*, which treats of the action of forces in producing motion in solid bodies. Formerly the latter alone was called dynamics, and to this, in conjunction with statics, the general name *mechanics* was given. In the wide sense dynamics includes also hydrodynamics. It is to Newton that we owe the clear statement of the three primary laws of force on which the science of dynamics is based. These are: (1) that every body remains in a state of rest, or of uniform motion along a straight line, unless it is compelled by force to change that state; (2) that rate of change of momentum is in proportion to the force employed, and occurs along the straight line in which the force acts; (3) that, as the result of every action, there is always an equal and opposite reaction. These laws, which were formulated from experiment, involve the conception of force as a primary influence or action expressed in terms of space, time, and matter. Now, in dealing with the laws of force, a standard of measurement is required which shall be applicable to all forces at all times, and we therefore require to begin by establishing units of space, time, and mass. There are two systems of units in use, the one British, the other French. In the British system

the foot is taken as the unit of length, and the second as the unit of time. In the French the centimetre is the unit of length, the second the unit of time; the unit velocity in the one case being that of one foot per second, in the other one centimetre per second. The British unit of mass is the pound (the mass of a certain lump of platinum deposited in the Exchequer Office, London); the French the gramme; and accordingly the French units of space, mass, and time are commonly known as the C.G.S. (centimetre, gramme, second) units. As the weight of a pound (or a gramme) is not the same at all parts of the earth's surface, it cannot give us of itself an absolute or dynamical unit of force, that is, an invariable unit; but taking it in conjunction with unit time and unit velocity, we do obtain such a unit. Two absolute units of force are in common use in dynamics, the *poundal* and the *dynes*; the latter being the absolute unit in the C.G.S. system. The former is *that force which, acting on the mass of one pound for one second, generates in that mass a velocity of one foot per second*. The latter is *that force which, acting on the mass of one gramme for one second, generates in that mass a velocity of one centimetre per second*. It is important in dynamics to distinguish between *mass* and *weight*. The *mass* of one pound is the quantity of matter equal to a certain standard quantity (a certain lump of metal) and is quite independent of force. The *weight* of one pound is the force with which the mass of one pound is attracted to the earth's surface by the force of gravity. Another important term is *momentum*: the momentum of a body in motion at any instant is the product of the mass of the body and the velocity at that instant. See *Couple*; *Elasticity*; *Energy*; *Force*; *Hydrodynamics*; *Kinematics*; *Kinetics*; *Statics*; *Thermodynamics*; *Waves*.—BIBLIOGRAPHY: Kelvin and Tait, *Natural Philosophy*; A. Gray, *Dynamics*; P. G. Tait, *Dynamics*; S. L. Loney, *Mechanics and Hydrostatics for Beginners*.

**Dynamite.** See *Explosives*.

**Dyn'amo.** See *Generator*.

**Dynamom'eter**, an apparatus for measuring the power or rate of working of a machine. There are two types, the transmission dynamometer, which measures the power of the machine without sensibly diminishing it; and the absorption dynamometer, which measures the power by using it all. The instrument is generally employed to determine the horse-power transmitted by a shaft or by belting.—Cf. Aspinall Parr's *Electrical Engineering Testing*.

**Dyrrhachium.** See *Durazzo*.

**Dy'sart**, a royal and municipal burgh of Scotland, in Fife, on the Firth of Forth. It is an old place, and is a member of the Kirkcaldy district of parliamentary burghs. Pop. of royal burgh, 4197.

**Dys'entery** is a disease of an acute type, due to the action of a bacillus, characterized by pain and frequent passage of blood and mucus. Owing to improved sanitation, dysentery has become less frequent. In temperate countries sporadic cases occur from time to time, and occasional epidemics break out, but in the tropics widespread epidemics occur, and the disease is a serious menace. It is a very frequent camp disease, and has been the scourge of all armies in tropical and semi-tropical regions. The bacilli are widely spread by the faeces of infected persons, and usually the infection takes place by the mouth. The onset is rapid, and marked by fever, pain in the abdomen, and frequent stools. At first mucus only is seen in the stools, but soon blood appears. In very acute cases the patient is seriously ill in forty-eight hours, and may die on the third or fourth day. Moderate cases may go on for several weeks, with resulting convalescence. Some cases become chronic in type, and a person may have chronic dysentery for years. Bismuth in large doses is given, and morphia is a most useful drug to relieve the pain and quieten the bowel. Normal saline solution is given by rectum after the acute stage, whenever possible. Chronic dysentery requires dietetic treatment for the persistent dyspepsia and irritability of the bowel. Amœbic dysentery, due to the *Amœba dysenteriae*, is a distinct disease.

**Dys'odile**, a yellowish or greenish foliated carbonaceous substance found in Sicily originally, and derived from the decay of minute organisms. When ignited, it burns and emits a very unpleasant smell.

**Dyson**, Sir Frank Watson, F.R.S., LL.D. (Edin.), British astronomer, born at Ashby 8th Jan., 1868, the son of a Baptist minister. Educated at Bradford Grammar School and Trinity College, Cambridge, he became chief assistant at the Royal Observatory, Greenwich, in 1894, and secretary of the Royal Astronomical Society in 1899. Astronomer Royal for Scotland in 1905, he was appointed Astronomer Royal for England in 1910. He was knighted in 1915.

**Dyspep'sia**, or Gastritis, may be either acute or chronic. *Acute dyspepsia* may follow when more food is taken than the stomach can digest, or when unsuitable articles are taken. The symptoms are headache, depression, nausea, vomiting, with pain, varying from a feeling of discomfort in the abdomen to marked tenderness. The tongue is furred, and usually there is diarrhoea, while in the more severe attacks the onset is marked by chill and a rise of temperature. An attack may last from one day to four days. Treatment for mild cases is simply a dose of castor-oil (children) or blue pill (adults), but in severe cases vomiting should be promoted by warm water, or the stomach tube if necessary,

and a dose of calomel (3 grains), followed by salts, should be given. Absolute rest to the stomach is necessary, and only small quantities of water allowed. Repeated attacks lead to the establishment of the chronic form. *Chronic dyspepsia* is a condition of disturbed digestion due to the prolonged use of unsuitable, or improperly prepared, foods. Hot cakes, excess of tea, coffee, or alcohol, rapid and irregular meals are all common causes. It may also arise in the course of diseases like anæmia, chronic tuberculosis, gout, Bright's disease, chronic heart disease, cirrhosis, and in diseases of the stomach itself, as cancer, gastric ulcer, and gastric dilatation. The most common symptoms are a feeling of oppression after food, tenderness over the stomach, headache, nausea, flatulence, constipation, and occasionally vomiting. Treatment consists of dietetic measures, regulated exercises, change of air and surroundings, and avoidance of depression. Milk should be used freely, and in severe cases should be given alone till improvement sets in. Fats and greasy dishes should be avoided. Fruits are sometimes well borne, and at other times the reverse. Drugs do not play so important a rôle, but bitter tonics, like nuxvomica, quassia, gentian, &c., are the best. Constipation should be treated when necessary.

Dysphonia is difficulty in speaking, and is the result of some forms of laryngitis. The condition is aggravated by attempts to use the

voice, and complete rest is necessary to bring about an early and satisfactory recovery. Tonics, moderate exercise, and a holiday hasten recovery.

Dyspnoea (dis-pnē'a) is difficult or laboured breathing. It is a symptom of diseases of the heart or lungs, and is produced by any condition which interferes with normal respiration. It is sometimes present in nervous disturbances.

Dze'ren, or Dze'ron, the Chinese antelope, a remarkably swift species of antelope (*Procapra gutturosa*) inhabiting the dry arid deserts of Central Asia, Tibet, China, and Southern Siberia. It is nearly 4½ feet in length, and 2½ feet high at the shoulder.

Dzīg'getai, or Kiang (*Equus hemionus*), a species of wild ass native to Central Asia, allied both to the horse and ass. Its head is large like that of the ass, but in form resembles that of the horse. The ears also resemble those of the horse. It runs with a rapidity exceeding that of the best Arabian horses.

Dzoungaria, or Sungaria, a Chinese territory in Central Asia, stretching from about 43° to 48° N. lat. and from about 82° to 86° E. long. It has an area of 147,950 sq. miles, and pop. 600,000. It is administratively connected with Kuldja, and since the surrender of Kuldja by the Russians in 1880 is again under Chinese rule. Dzoungaria, once the centre of an independent empire, was first conquered by the Chinese in 1757.

## E

E, the second vowel and the fifth letter of the English alphabet. It occurs more frequently in English words than any other letter of the alphabet. Its long or natural sound in English coincides with the sound of *i* in the Italian and French languages, as in *here*, *mere*, *me*. It has also another principal sound, a short one, heard in *met*, *men*. It has besides a sound like *a* in *bare*, as in *there*, *where*, &c., and the obscure sound which is heard in *her*. As a final letter in English it is generally silent, but it serves to indicate that the preceding vowel is to have its long sound, as in *mane*, *cane*, *plume*. When two *e*'s come together the sound is generally the same as that of the single *e* long, as in *deem*, *esteem*, *need* (compare, however, *pre-exist*, &c.).

E, in music, is the third note or degree of the diatonic scale, answering to the *mi* of the Italians and French.

Eadie (Ē'di), John, D.D., a Scottish preacher and theologian, born 1810, died 1870. He was educated at Glasgow University, and entered the ministry of the Secession Church, becoming in 1843 professor of biblical literature in the Divinity Hall of the Church, a post which he

continued to hold after the Secession body was merged in the United Presbyterian Church (in 1847). Among his works are *Biblical Cyclopædia*; *Analytical Concordance to the Scriptures*; *Ecclesiastical Cyclopædia*; *Commentary on the Greek Text of Ephesians*, and similar works on *Colossians*, *Philippians*, and *Galatians*; and *The English Bible*. He was one of the scholars engaged on the Revised Version of the New Testament.

Ead'mer, an English monk, the friend and biographer of St. Anselm. In 1120 he was chosen Bishop of St. Andrews; but as the Scottish king refused to recognize the right of the Archbishop of Canterbury to consecrate him, he returned to England and died a simple monk about 1124. Besides the life of St. Anselm, Eadmer wrote lives of St. Wilfrid, St. Dunstan, St. Odo, and other English saints, as well as a valuable history (*Historiæ Novorum*) of events in England and the English Church from 1066 to 1122.

Eagle (Lat. *aquila*, Fr. *aigle*), the general name of raptorial birds that form a group or sub-family (Aquilinæ) of the great family Fal-

conidae, which includes the eagles, falcons, and hawks. The eagle is popularly regarded as the noblest and most courageous of the rapacious



Imperial Eagle (*Aquila mogilnik*)

birds. It soars to a greater height than any other European bird, from which circumstance the ancients considered it as the bird or messenger of Jove. The genus *Aquila*, which in-



African Sea-eagle (*Haliaeetus vocifer*)

cludes the most typical eagles, is distinguished by its long and powerful bill, the curve commencing at the cere, by its wings reaching to the tip of the tail, and by its tarsi being feathered to the toes. The imperial eagle (*A. mogilnik*)

of Central Europe, North-East Africa, India, and China is probably the species to which the popular belief in the courage, strength, and nobleness of eagles is to be traced. *A. chrysaetus*, the golden eagle, is the chief British species. It measures over 6 feet from tip to tip of the expanded wings, and 3 feet from the beak to the end of the tail. The adults have the body brownish, becoming darker with age; the feathers of the head and neck pointed, and of a golden-red hue. This species is found all over the northern hemisphere. It was once common in the Highlands of Scotland, but is now becoming rare. The Kirghis and other tribes of Central Asia use the golden eagle to kill antelopes, foxes, and even wolves. Another British eagle is the erne or sea-eagle (*Haliaeetus albicilla*) found near the sea-coast or lakes, and feeding largely on fish. The general colour is greyish-brown, the head pale-coloured, the tail white. The bald eagle (*Haliaeetus leucocephalus*), found in North America and North-East Asia, is the symbol of the United States, though Franklin deprecates the selection on account of his mean and dishonest habit of robbing the industrious osprey of the fish caught by him. Like all members of the genus, his diet is less restricted than that of the true eagles; and he even takes carrion. See also *Harpy Eagle*.

Eagle, as a symbol. The eagle first appears as a war standard amongst the Persians, through whom it reached the Egyptians. As the standard of the Roman armies it was first used by Marius, and afterwards took the place of all the other emblems at the head of the legions. It was first made of wood, then of silver, and finally, under Caesar and his successors, of gold. In the Mediaeval Ages the eagle became the heraldic emblem of the Holy Roman Empire, and was made double-headed in the fourteenth century. When the Holy Roman Empire fell to pieces in 1806, the double-headed eagle was retained by Austria. The double-headed eagle was assumed by Tsar Ivan III in 1472, and became the national military symbol of Russia; the single-headed eagle was assumed by the modern German Empire in 1871, and by the United States of America. The American eagle stands with outspread wings guarding a shield, with the motto *E pluribus unum*. The eagle was also the badge of several orders, the



Roman Standard

chief of which were the order of the *Black Eagle*, founded by the Elector of Brandenburg in 1701, and the highest order in Prussia; the order of the *Red Eagle*, also a Prussian order, and founded in 1705; and the Russian order of the *White Eagle*, originally Polish, and instituted in 1825.

**Eagle**, a gold coin in the United States of the value of ten dollars, or £2 sterling, first coined in 1795. There are also half-eagles, quarter-eagles, and double-eagles.

**Eagle-hawk**, a name sometimes applied to small South American eagles (genus *Morphnus*), with short wings and long legs.

• **Eaglehawk**, a gold-mining town in Victoria, Australia, 4 miles from Bendigo. Pop. 8130.

**Eagle-owl**, a name for several large horned owls, such as *Bubo ignavus* (the great horned owl), little inferior in size to the golden eagle, found in many parts of Europe and sometimes in Britain. An allied species, the Virginian horned owl (*H. virginianus*), is common in the United States.

**Ealing**, a municipal and parliamentary borough of Middlesex, the former a few miles west of London. Pop. 61,322.

**Ear**, the organ of hearing. In the higher vertebrates it is divided into the outer, middle, and

transmits the vibrations to certain little bones of the cavity of the tympanum. These bones, which have been named respectively the hammer (*malleus*), the anvil (*incus*), and the stirrup (*stapes*), transmit the vibrations to the internal ear, forming a chain communicating at one end with the membrane just mentioned, and at the other with the inner ear. The internal ear consists of a complicated system of tubes known as the *membranous labyrinth*, containing fluid in which waves are set up by the vibrations transmitted to it by the little bones from the drum membrane. The lower part of the labyrinth is coiled like a snail shell, and is called the *cochlea*. It is the real organ of hearing. The upper part consists of three *semicircular canals*, the function of which is to record the position and movements of the body in space. The middle ear communicates with the pharynx by the Eustachian tube, through which air from the mouth may be introduced into the tympanic cavity, so as to permit vibrations of the drum membrane. In the external auditory canal of the ear is produced the cerumen or ear-wax. The cut shows P the concha, E.C. the external canal, D the drum membrane partly removed, S the stirrup, A the anvil and H the hammer, the small bones communicating with the drum and vestibule, C cochlea, S.C. semicircular canals, E. Eustachian tube.—Cf. Sir Thomas Wrightson, *An Enquiry into the Analytical Mechanism of the Internal Ear*.

**Ear-cockle**, a disease in wheat caused by the presence in the grain of worms belonging to the genus *Vibrio*. It is called in some parts of England *purples*.

**Earl** (A.Sax. *corl*; Dan. *jarl*), a degree of the British nobility between marquess and viscount, the title of highest antiquity in England. The title was made hereditary by William the Conqueror, and for a time was used interchangeably with that of *count*, the corresponding title on the Continent. The wife of an earl is still called a *countess*. The earl was the highest in rank of the nobility until Edward III created a duke in 1337, and Richard II a marquess in 1385. The first earl of England is the Earl of Arundel. An earl's coronet is composed of eight pearls raised upon points, with small leaves between, above the rim. See *Peer*.

**Earle**, John, English bishop and writer, born about 1601, died 1665. He was educated at Oxford, and, after writing some short poems, gave to the world anonymously in 1628 *Microcosmographie, or a Piece of the World discovered in Essays and Characters*—a work full of wit, humour, and admirable character-painting. He was tutor to Charles II, accompanied him during his exile, and was held by him in the highest esteem. In 1662 he was consecrated Bishop of



Diagrammatic Section of Outer, Middle, and Inner Ear

P, Concha. E.C., External canal. D, Drum. H, Hammer. A, Anvil. E, Eustachian tube. S, Stirrup. S.C., Semicircular canals. C, Cochlea. Arrows denote the direction of vibration.

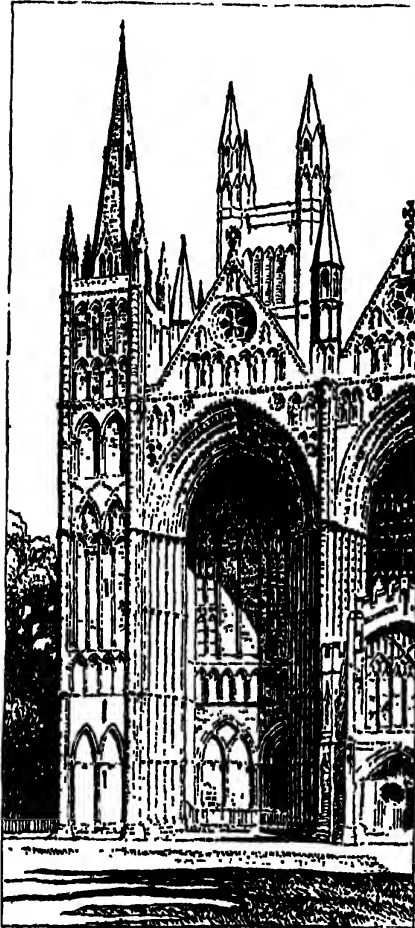
inner ear. The external ear, which is a cartilaginous funnel for collecting the sound waves and directing them inwards, is composed of the *concha*, or projecting part, and of the *auditory canal*, which extends from the *concha* to the membrane of the *tympanum* or *drum*. This membrane is a partition stretched obliquely across the bottom of the auditory canal, which it separates from the middle ear or tympanum; it is semi-transparent and very delicate. It vibrates with the waves of sound which strike against it, and



Worcester, and next year was translated to Salisbury.

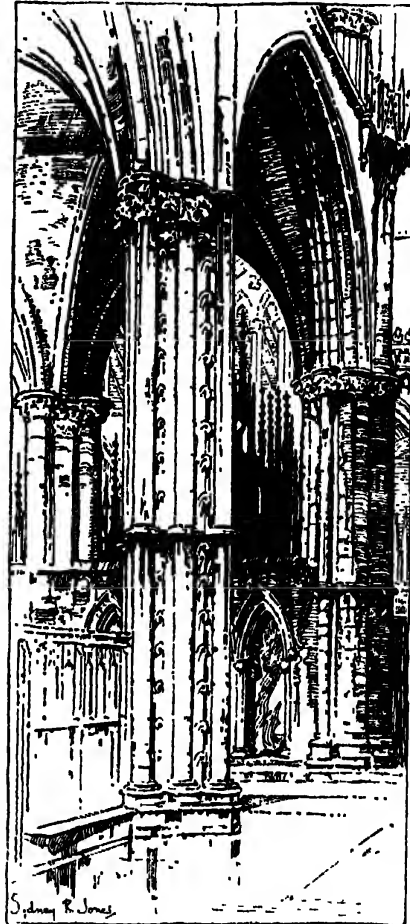
Earle, Rev. John, Anglo-Saxon scholar, was born in 1824, and died in 1903. He studied at Oriel College, Oxford, where he obtained first-class honours in classics, and was elected a fellow (1848). In the following year he took

*Saxon Chronicles Parallel* (1865); *The Philology of the English Tongue* (1871); *A Book for the Beginner in Anglo-Saxon* (1877); *English Plant Names from the Tenth to the Fifteenth Century* (1880); *Anglo-Saxon Literature* (1884), a very useful and informing little manual; *Handbook to the Land Charters and other Saxon Documents*



Early English Architecture

Peterborough Cathedral. Part of the West Front



Lincoln Cathedral. Early English Pillars in the Eastern Transept

orders, and was appointed for five years university professor of Anglo-Saxon. In 1857 he became rector of Swanswick, near Bath, and in 1871, a prebendary of Wells. The five years' rule having been rescinded, he was re-elected professor of Anglo-Saxon at Oxford in 1876, and continued to hold the position, together with the rectory of Swanswick, until his death. Among his contributions to the study of Anglo-Saxon and modern English are the following: *Two*

(1888); *English Prose: its Elements, History, and Usage* (1890); *The Deeds of Beowulf* (1892), a translation of the well-known Anglo-Saxon epic; *The Psalter of 1539* (1894); and *A Simple Grammar of English now in Use* (1898). He also wrote a book on *Bath, Ancient and Modern* (1864).

Earlestown, a town of Lancashire, England, 14 miles east of Liverpool. There are here engineering - works, sugar - works, and other establishments. Pop. 9020.



**Earl-marshal**, a great officer of England, who had, anciently, several courts under his jurisdiction, as the court of chivalry and the court of honour. He is the head of the College of Arms (Heralds' College), grants armorial bearings, and determines all claims in connection with them. Since 1672 the office is hereditary in the family of Howard (Dukes of Norfolk). There was also an earl-marshal of Scotland, the office being hereditary in the Keith family until 1716, when it was abolished.

**Earlom**, Richard, English mezzotinto engraver, born 1748, died 1822. His engravings from Reynolds, Hogarth, Van Huysum, &c., and from Claude's *Liber Veritatis*, are exceptionally fine, and are standard works in their department.

**Earlston** (originally Ercildoun), a village of Scotland in Berwickshire. Near it are the ruins of the ancient tower, which belonged to the famous Thomas the Rhymer. Pop. 1740.

**Early English Architecture**, the first of the Pointed or Gothic styles of architecture that prevailed in England. It succeeded the Norman in the reign of Richard I (1189), and continued to the end of the reign of Henry II in 1272, a period of 123 years, when it gradually merged into the Decorated style. One of the leading peculiarities in this style is the form of the windows, which are narrow in proportion to their height, and terminate in a pointed arch, resembling the blade of a lancet (and therefore often called the *Lancet* style). Throughout the early period of the style they are very plain, particularly in small churches; but in cathedrals and other large buildings the windows, frequently combined two or more together, are carried to a great height, are richly and deeply moulded, and the jambs ornamented with slender shafts. On the eastern and western fronts of small churches the windows are often combined in this manner, with a circular window above and a richly moulded door below; but in large buildings there is often more than one range of windows, and the combinations are very various. Though separated on the outside, these lancets are in the interior combined into one design, thus giving the first idea of a compound window. The doorways are in general pointed, and in rich buildings sometimes double; they are usually moulded, and enriched with the tooth-ornament. The buttresses are often very bold and prominent, and are frequently carried up to the top of the building with but little diminution, and terminate in acutely pointed pediments, which, when raised above the parapet, produce in some degree the effect of pinnacles. In this style, likewise, flying-buttresses were first introduced (see *Buttresses*), and the buttresses themselves much increased in projection owing to the comparative lightness of the walls, which required some

counter-support to resist the outward pressure of the vaulting. The roof in the Early English style appears always to have been high pitched, and the towers surmounted by lofty pointed spires, as at Salisbury Cathedral. In the interior the arches are usually lancet-shaped, and the piers often reduced to very slender proportions.

To give still greater lightness of appearance, the piers are frequently made up of a centre pillar, surrounded by slight detached shafts, only connected with the pillar by their capitals and bases, and bands of metal placed at intervals. These shafts are generally of Purbeck marble, the pillar itself being of stone, and from their extreme slenderness they sometimes appear as if quite inadequate to support the weight above them. The earliest example of Early English architecture is the choir of Canterbury, followed

by the choir of Lincoln Cathedral, but some of the best examples are to be seen in Salisbury Cathedral. The architects of this style carried their ideas of lightness to the utmost limits of prudence, and their successors have been afraid to imitate their example. The abacus



Early English Capital, Salisbury

of the capitals is generally made up of two bold round mouldings, with a deep hollow between. The foliage is peculiar, generally very gracefully drawn, and thrown into elegant curves; it is usually termed *stiff-leaved*, from the circumstance of its rising with a stiff stem from the neck-mould of the capital. The trefoil is commonly imitated, and is very characteristic of the style. The mouldings of this style have great boldness, and produce a striking effect of light and shade. They consist chiefly of rounds separated by deep hollows, in which a peculiar ornament, called the *dog's-tooth*, is used, whenever ornament can be introduced. This ornament is as characteristic of the Early English as the zigzag is of the Norman. See *Dog's-tooth*.—Cf. F. Bond, *An Introduction to English Church Architecture, from the 11th to the 16th Century*.

**Earnest**, in law, any sum paid in advance, to bind parties to the performance of a verbal agreement, or something given by a buyer to a seller as a pledge of adherence to a bargain. The party is then obliged to abide by his bargain, and is not discharged upon forfeiting his earnest. In England the general view is that the sum paid as earnest, however small, is part of the price.

**Ear-ring**, an ornament for the ear, consisting of a ring or hook passing through the lobe, with a pendant of diamonds, pearls, or other jewels frequently attached. Ear-rings were commonly worn amongst the Oriental nations, and by both sexes, especially in Babylonia and Assyria, from the earliest times. Amongst the Greeks and Romans the wearing of ear-rings was usually confined to women. In England the Romanized Britons and the Anglo-Saxons wore them, but the fashion declined in the tenth century, and was again introduced in the sixteenth century, in Queen Elizabeth's time.

**Earsdon**, an urban district or town of England, South Northumberland, several miles north-west of Tynemouth, with productive collieries. Pop. 10,568.

**Earth**, the planet which we inhabit, a nearly spherical body which every twenty-four hours rotates from west to east round an imaginary line called its axis—this axis having as its extremities the north and south poles—while in the course of a year it completes a revolution round the sun. To an observer whose view is not obstructed, the visible part of the earth appears as a circular and horizontal expanse, on the circumference of which the heavens appear to rest. Accordingly, in remote antiquity, the earth was regarded as a flat, circular body, floating on the waters. But even in antiquity the spherical form of the earth began to be suspected. It is only on this supposition that we can explain how the horizon of vision grows wider and wider the higher the position we choose, how the tops of towers and mountains at a distance become visible before the bases, how the hull of a ship first disappears as she sails away, and how, as we go from the poles towards the equator, new stars become visible. Besides these proofs there are many others, such as the circular contour of the earth's shadow seen on the moon during an eclipse. The mere fact that the earth can be circumnavigated does not, as is sometimes assumed, prove it to be globular. But its surface, land and ocean, has been almost all explored and accurately mapped, and the relative distances and directions found to obtain between the places on its surface are consistent only with its possessing such a shape.

The earth is not, however, an exact sphere, but is very slightly flattened at the poles, so as to have the form known as an *oblate spheroid*. In this way the *polar diameter*, or diameter from pole to pole, is shorter than the diameter at right angles to this—the *equatorial diameter*. The most accurate measurements make the polar diameter almost 27 miles less than the equatorial, the equatorial diameter being found to be 7926·7 miles, and the polar 7900 miles. The earth is regarded as divided into two halves—the northern

and the southern hemisphere—by the *equator*, an imaginary line going right round it midway between the poles. In order to indicate with precision the position of places on the earth additional circles are imagined to be traced upon the surface in such a manner that those of the one set all pass through both poles, while those of the other are drawn parallel to the equator. The former are called *meridians*, the latter *parallels of latitude*, and by reference to them we can state the latitude and longitude, and thus the exact position, of any place.

Many experiments by various methods have been made in order to determine the average density of the earth, and the total quantity of matter it contains. Amongst these methods may be mentioned: (1) that of measuring the deflection of a plumb-line due to a mountain's attraction, and thereby comparing the mass of the earth with that of the mountain; (2) that founded on the difference of oscillation period of a pendulum when placed at the summit of a mountain and when at the sea-level; (3) by the determination of the difference of gravity at the top and the bottom of a deep mine, by pendulum experiments; (4) Cavendish's experiment with the torsion balance, which attempts to compare the attractive force of two large lead balls upon two small lead balls with that exercised by the earth. From these and other experiments it has been calculated that the mean density of the earth is to that of water as about  $5\frac{1}{2}$  to 1.

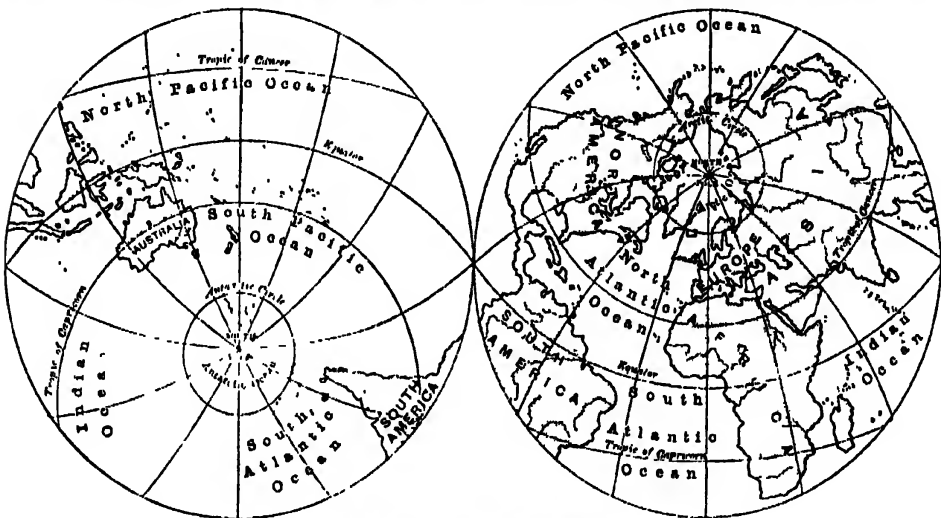
The earth, in common with the other planets, moves round the sun, completing its revolution in about 365 days and 6 hours. The orbit of the earth is an ellipse, with the sun in one of its foci. Hence the earth is not equally distant from the sun throughout the year; it is over 3,000,000 miles nearer at one time than another, its least distance (*perihelion* distance), according to recent calculations, being about 91,340,000 miles; its greatest (*aphelion* distance), 94,450,000; and the mean distance, 92,897,000 miles. From this it may be calculated that the velocity of the earth in its orbit is about  $18\frac{1}{2}$  miles a second. About 3rd Jan. the earth is nearest the sun, and about 4th July farthest from it. This position of matters, which is subject to slow alteration in the course of ages, at present tends to moderate the seasonal variations in the northern hemisphere, and to intensify them in the southern. The passage of the earth round its orbit causes the sun to appear as if it described an annual circuit of the heavens; and hence it is that at one time of the year one group of stars is seen in the neighbourhood of the sun near sunrise or sunset, and at another time another group. This apparent path of the sun is the *ecliptic*, and corresponds with what would be the path of the earth as seen from the sun; and the groups of

stars through which the sun successively passes form the *zodiac*.

The earth's daily motion about its own axis takes place in twenty-three hours, fifty-six minutes, and four seconds of mean time. This diurnal revolution is the occasion of the alternation of day and night. As the axis on which the earth performs its diurnal rotation is inclined towards the plane of its path about the sun at an angle of  $66\frac{1}{2}^{\circ}$ , and the angle between the plane of the ecliptic and the plane of the earth's equator is therefore  $23\frac{1}{2}^{\circ}$ , the sun ascends in the heavens, as seen from our northern latitudes, from 21st March to 21st June (the summer *solstice*), to about  $23\frac{1}{2}^{\circ}$  above the celestial equator, and

lively the *arctic* and the *antarctic* circle, and the regions themselves the *polar* or *frigid* zones. Throughout a region extending to  $23\frac{1}{2}^{\circ}$  on each side of the equator the sun is directly overhead at any place twice in the year. The circles which bound this region are called the *tropics*, that in the northern hemisphere being the tropic of *Cancer*, that in the southern the tropic of *Capricorn*, while the region between is the *torrid* zone. The regions between the tropics and the polar circles are respectively the *north* and *south temperate* zones.

From the evidence furnished by volcanoes, hot springs, sinking of mines, &c., it is known that the earth has a high internal temperature.



The Hemispheres, showing the Greatest Masses of Land and Water

descends again towards the equator from 21st June to 23rd Sept.; it then sinks till 22nd Dec. (the winter *solstice*), when it is about  $23\frac{1}{2}^{\circ}$  below the equator, and returns again to the equator by 21st March. This arrangement is the cause of the seasons, and the inequality of day and night attending them. For all places removed from the equator, day and night are equal only twice in the year (at the *equinoxes*). At the summer solstice in the northern hemisphere the north pole of the earth is turned towards the sun, and the south pole away from it, and for places within  $23\frac{1}{2}^{\circ}$  of the former there is a period of longer or shorter duration during which the sun is continually above the horizon throughout the twenty-four hours of each day, while round the latter there is an equal extent of surface within which the sun for similar periods is below the horizon. (See *Day*.) The reverse state of matters occurs at the winter solstice. The circles bounding these regions are called respec-

Taking the average of the various observed rates of increase this temperature seems to increase  $1^{\circ}$  F. for every 60 feet of descent. Assuming this to continue, the rocks at a depth of 2 miles would be as hot as boiling water, and at a depth of 50 miles the heat would be such as at the surface would melt every known solid. This being so, various theories as to the internal condition of the earth have been proposed: (1) that a thin envelope or crust surrounds a molten interior. It can be shown, however, that as tides must be produced in such a molten mass the cool outer crust would be unable to withstand the enormous force of these unless it were about 2000 miles thick. (2) That the interior is solid, with spaces here and there filled with liquid or gaseous material. This theory assumes that there are within the earth enormous cavities filled with molten rock, which escapes, when local pressure is removed, in the form of volcanic outbursts. (3) That the earth consists of a thin

crust, a large solid nucleus, and a liquid film between the nucleus and the crust. (4) That the earth is solid to the centre, but any part may become liquid if local pressure is removed. On this theory it is supposed that if water should percolate to liquefied rocks, it would be converted into steam, and produce the various volcanic phenomena.

The question of the constitution of the earth's interior has in recent years been much investigated by means of seismographic records. These appear to indicate that there are three distinct divisions. The outer crust has a thickness of from 20 to 40 miles. It possesses a high power of resistance to all kinds of stress. Beneath it is a large shell possessing a density and elasticity resembling fine steel. This shell has a high rigidity against changing forces of shorter duration, like tidal action, but in its outer parts at least yields in time to unvarying long-continued stress. The third or innermost division of the earth is probably molten, as it can transmit compressional waves, but yielding immediately to distortional or twisting forces, is unable to transmit distortional waves. This innermost portion appears to be a sphere of radius approximately one-half that of the earth as a whole. The transition between the crust and intermediate shell is abrupt, but that between the latter and the central portion is more gradual.

The earth (like the other planets) is believed to have condensed and solidified from a gaseous or nebular condition, and to have once had a far higher temperature than now. If such were the case, the outer surface, losing heat by radiation, would be the first part to cool quickly; while the interior, losing its heat by conduction, would not cool so rapidly, and, therefore, would naturally have a higher temperature than the portion at the surface. This is what all observations indicate the condition of the earth to be, and the shape of the earth also indicates that it must once have been in a fluid state. Calculations have been made of the time which has elapsed since solidification commenced, the estimates being in general of the order of hundreds of millions of years. See *Nebular Hypothesis*.

Another feature that the earth as a whole presents is its magnetism. When a magnetic needle is balanced on a point, it remains at rest in one position only, pointing then nearly due north and south. This can be explained only on the supposition that the earth acts as a great magnet. It has, in fact, two poles—a north and a south magnetic pole—which are not very far from the geographical poles. The magnetic equator, where the vertical force is zero and the dipping needle takes a horizontal position, does not diverge greatly from the geographical equator. The earth acts upon all magnets as they act upon

each other, and it is for this reason that they point north and south.

The surface of the earth contains over 196,000,000 sq. miles, of which about two-sevenths is dry land, the remaining five-sevenths being water. The land is arranged into masses of irregular shape and size, the greatest connected mass being in the eastern hemisphere. The chief masses receive the name of continents, detached masses of smaller size being islands. The surface of the land is variously diversified, exhibiting mountains, valleys, plains, plateaus, deserts, &c. The water area of the earth is divided into oceans, seas, bays, gulfs, &c., while rivers and lakes may be regarded as features of the land surface. The great phenomena of the oceans are currents and tides. The population of the whole earth is estimated at from 1600 to 1700 millions. The earth is attended by the moon as a subordinate or secondary planet. See also such articles as *Climate*, *Currents*, *Ocean*, *Earthquake*, and *Seasons*.—BIBLIOGRAPHY: A. von Humboldt, *Cosmos*; E. Reclus, *The Earth and its Inhabitants*; T. G. Bonney, *The Story of our Planet*; T. M. Reade, *The Evolution of Earth Structure*; *Theory of Geomorphic Changes*; A. T. Swaine, *The Earth: its Genesis and Evolution, considered in the Light of the most Recent Scientific Research*.

Earthenware, a name applied to the commoner sorts of pottery-ware. The older kinds of earthenware, such as Majolica, Delft-ware, Faience, and Palissy-ware, are not only glazed, but are besides elaborately coloured and enamelled and ornamented with raised figures of various kinds. See *Pottery and Porcelain*.

Earth-houses, a name generally given throughout Scotland to underground buildings, also known as 'Picts' houses' or 'Picts' dwellings'. The earth-house in its simplest form consists of a single irregular-shaped chamber, formed of unhewn stones, the side walls gradually converging towards the top until they can be roofed by stones of 4 or 5 feet in width, all covered in by a mound of earth rising slightly above the level of the adjacent ground. In the more advanced form of these structures two or three chambers are found. Earth-houses are frequent in the north-east of Scotland, occasionally thirty or forty being found in the same locality. Querns, bones, deer's horns, earthen vessels, cups and implements of bone, stone celts, bronze swords, and the like, are occasionally found in connection with them. Very similar structures, known as beehive-houses, occur also in Ireland and Cornwall.

Earth-nut, the *Conopodium denudatum*, an umbelliferous plant common in woods and fields in Britain. The leaves are ternately divided, and the small white flowers are in terminal

umbels. The tuber or nut is about 4 or 6 inches below the surface, at the termination of a long slender root. It is brown, the size of a chestnut, of a sweetish farinaceous nature, resembling in taste the common chestnut. Swine are very fond of the nuts, and fatten rapidly where they are abundant. The name is frequently applied to *Carum Bulbocastanum*, which has a similar tuber. See *Ground-nut*.

**Earthquake**, a shaking of the earth's surface, propagated from place to place by a wave motion. It may vary in intensity from the slightest perceptible tremor to a violent shock which bursts open chasms and changes the appearance of the ground. Earthquakes originate in the crust of the earth, generally at only a very few miles depth, and probably never lower than about 30 miles. The point of origin is called the centre or seismic focus, and the place on the surface vertically over it the epicentre. It is rather difficult to tell the depth of the focus. Mallet estimated this by projecting backward the direction of travel of the wave at different points, as judged from the inclinations of the rents in buildings, &c., assumed to be at right angles to the line of propagation. The accuracy of this method has been improved by substituting evidence of direction as given by seismographs. The focus of an earthquake is often submarine, and subsequent to the shock transmitted through the solid earth a great sea-wave may invade the land and produce far more disastrous effects.

In some cases an earthquake may be caused by a fall of rock in some subterranean cavity. This gives only a minor and local shock. The vast majority of earthquakes are certainly *tectonic*, originating from the snapping of strata under great strain, or the further slipping of portions of the earth's crust along previously existing fault planes. Such dislocations probably arise sometimes from the variations of weight supported by the earth's crust in neighbouring regions, due to the transport by rivers of material, which they erode at one place and deposit at another. A further cause is the contraction undergone by the earth in its secular cooling. There are also earthquakes of *volcanic* origin, accompanying eruptions, but these are not usually of any great violence, nor do they involve any large area. The coasts of the Pacific Ocean—American, Asiatic, and East Indian—are much visited by earthquakes, in especial the Japanese Islands. The other band of greatest frequency has a direction outlined by the Azores, Alps, Mediterranean, and the Caucasus and Himalaya Mountains. It may be noted that all the regions specially affected are distinguished by steep gradients of the earth's surface.

In recent years much information has been obtained by the investigation of earthquakes by

various kinds of seismograph. One single instrument at a particular station, e.g. a Milne seismograph, will enable the distance of the epicentre to be calculated. From the results of three stations, the precise locality can practically always be told. With additional or particular forms of instruments, this may even be possible by means of the records at one station. Earthquake waves are found to consist of distinctly defined types. The first to arrive are the preliminary tremors or first-phase waves, then the second-phase waves, next the third-phase or large waves, and lastly the concluding waves, consisting largely of 'echoes' or reflected vibrations. The speed of the preliminary tremors is found to be only about 2 miles per second for very short distances, but for a quadrant of the earth's surface they travel at an average of about 7 miles per second, a speed which is only slightly

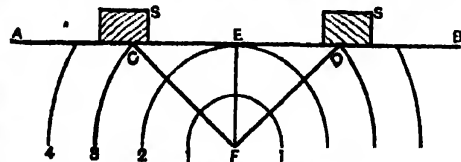


Diagram of Earthquake

AB, Surface of earth. F, Focus. E, Epicentre. 1-4, Successive positions of earthquake wave. s, s, Cracked walls; the cracks being at right angles to CF and DF give some indication of the depth of focus.

exceeded for still greater distances. The second-phase waves travel with a little under two-thirds of these velocities. These two classes of wave have been proved to travel through the earth, approximately along chords, but with the path slightly bent, convex towards the earth's centre. The first-phase waves are longitudinal, or waves of compression; the second-phase are transverse, or waves of distortion. The greater speed for greater distances is due to the track being more through the earth's interior and less through its outer portions, as the interior transmits wave-motion much more rapidly than the crust. The rigidity at some depth from the surface has been shown to be of the same order of magnitude as the rigidity of steel. The third-phase waves are of much longer vibration period and wide amplitude, and have been compared to a ground-swell on the sea. Their time of passage from the epicentre to any place is proportional to the distance measured round the earth's surface, and it is clear that they travel on the surface, and not through the interior. Their speed is nearly 2 miles per second. The difference in time between the arrival of the preliminary tremors at any station and the arrival of the second-phase waves, or between the second-phase and third-phase waves, enables the distance of

the epicentre to be easily found, as these differences, of course, become greater with increasing distance.

The number of earthquakes has been found to be enormously greater than was at one time supposed; in fact, small tremors are occurring daily in one part or another of the earth. Great and destructive shocks are generally preceded by minor shocks in the same district, and they are always followed for months afterwards by a series of gradually lessening after-shocks. Among the most remarkable earthquakes of modern times were those which destroyed Lima in 1740, and Lisbon in 1755; more recently destructive earthquakes visited Calabria in 1857, Peru and Ecuador in 1868, the Island of Ischia in 1884, Japan in 1890, North India and Calabria in 1905, San Francisco in 1906, Messina and Reggio in 1908. One of the greatest earthquakes of recent times was that which visited the provinces of Kansu and Shensi in North-West China, on 16th Dec., 1920. (See *Seismograph*.)—BIBLIOGRAPHY: J. Milne, *Earthquakes and other Earth-Movements*; C. Davison, *A Study of Recent Earthquakes*; C. G. Knott, *The Physics of Earthquake Phenomena*.

**Earths**, a term applied in geology to certain loosely aggregated siliceous and aluminous materials, the detritus of pre-existing rocks. In chemistry the term earth is given to certain metallic oxides, such as the 'alkaline earths' lime, baryta, and strontia; also to alumina and a series known as the 'rare earths'. The earths were regarded as simple bodies until Sir H. Davy proved them to be compounds of oxygen with metals.

**Earth-shine**, in astronomy, a name given to the faint light visible on the part of the moon not directly illuminated by the sun, due to the illumination of that portion by the sunlight which the earth reflects on her. It is most conspicuous when the illuminated part of the disc is small, as soon after new moon. This phenomenon is popularly described as 'the old moon in the new moon's arms'.

**Earth-tongue**. See *Geoglossum*.

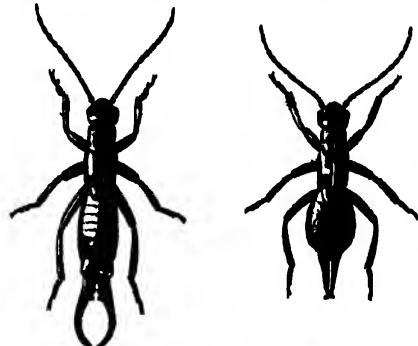
**Earthworks** (in fortification) are military works formed chiefly of earth and designed either as permanent or temporary defences. They are cheaper, more easily repaired, and expose their defenders to less risk from broken stone than stone-works. See *Fortrenchments*.

**Earthworm**, the name applied to segmented worms (Annelids) that burrow in the soil, and belong to the ord. Oligochaeta, a subdivision of the bristle-worms (Chaetopoda). They have a long, cylindrical body, divided by transverse furrows into numerous rings. The mouth is destitute of jaws, and they have no eyes, tentacles, or other head appendages. They are

hermaphrodite. The commonest British forms are chiefly species of *Lumbricus* and *Allolobophora*. They feed on earth and various kinds of animal and vegetable matter, and move by the contractions of successive parts of the body aided by a double row of bristles. They are of great service to the agriculturist by loosening the soil and increasing its depth. This is chiefly the result of their mode of nourishment, since they deposit the soil they have swallowed, after digestion, in heaps called *worm castings* which bring up rich fine soil to the surface, gradually covering the upper layer sometimes to the extent of several inches.

**Ear-trumpet**, an artificial instrument for aiding the collection of the vibrations or waves of sound, and carrying them in an intensified form to the internal parts of the ear. They are generally made of tin, vulcanite, or gutta-percha, and are of various forms. A small kind known as ear-cornets or acoustic auricles, attached to the ear by a spring, is sometimes used in slight cases of deafness.

**Earwig** (*Forficula*), a common orthopterous insect whose name is derived from its supposed



Earwig (*Forficula auricularia*). Male and female

habit of insinuating itself into the ears of persons. This is practically impossible, yet the notion is widely spread, as appears from the names given to the earwig in different languages, as in Fr. *perceoreille* (pierce-ear), in Ger. *ohrenhöhler* (ear-borer). Much damage is sustained by gardeners from the depredations of these insects among fruit and tender vegetables, which constitute their proper food. The earwig is about three-quarters of an inch in length, having the wings folded under very short and truncate elytra or wing-cases, and the extremity of the abdomen armed with a horny forceps.

**Easement**, in law, a right or privilege which one proprietor may have to use the land of another in connection with the needs of his own land, as the use of a way, a water-course, &c. The right to an easement may be acquired either



by grant or by uninterrupted enjoyment for a period of years.

**East**, one of the four cardinal points, being the point in the heavens where the sun is seen to rise at the equinox, or the corresponding point on the earth; that point of the horizon lying on the right hand when one's face is turned towards the north pole. By *the East*, in an indefinite sense, is often meant Syria, Arabia, Persia, India, and the eastern part of the world generally.

**Eastbourne**, a municipal borough and flourishing watering-place of England, county of Sussex, on the English Channel, near Beachy Head; also a parliamentary division of Sussex. The town is handsomely built, having fine parades and well-planted walks and drives. Pop. 52,544.

**East Cape**, the most easterly point of Asia, projecting into Behring's Strait nearly opposite Cape Prince of Wales in Alaska.

**Easter**, the festival commemorating the resurrection of Christ, observed in the Roman Catholic, the Greek, Anglican, Lutheran, and other branches of the Christian Church. By the first Christians it was considered to continue the feast of the *passover*, at which the paschal lamb, a type of Christ, was sacrificed. Hence its name in Greek (*pascha*), French (*pâques*), and other Romance languages is taken from the Hebrew *pesach*, *passover*. The English name, according to the Venerable Bede, comes from the Anglo-Saxon *Eostre* (from Teutonic *Austrō*), a goddess of light or spring, whose festival was celebrated in April. There was long a dispute in the Christian Church as to the proper time for holding Easter, the Christians of the East celebrating it on the same day as that on which the Jewish *passover* fell, that is, the 14th of Nisan (hence they were called *quarto decimani*), while the majority of the Church celebrated it on the Sunday next after this day. The controversy was decided by the Council of Nice (Nicæa) in 325, which settled that it was to be reckoned as at present, namely, that Easter is the first Sunday after the full moon which happens upon or next after the 21st of March; and if the full moon happens on a Sunday, Easter-day is the Sunday after, but, properly speaking, for the 'full moon' in the above the 'fourteenth day of the moon' should be substituted.—Cf. Sir J. G. Frazer, *The Golden Bough*.

**Easter Dues**, or **Offerings**, in the Church of England, certain dues paid to the parochial clergy by the parishioners at Easter as a compensation for the tithe for personal labour.

**Easter Eggs**. The egg was anciently a symbol of the mother goddess and of birth: the sun emerged from the cosmic egg. The Saxon goddess Easter was a life-giver. On Easter Day, the day of Christ's resurrection, eggs (*Pasche*

eggs) were dyed in symbolic colours, and boiled hard to be rolled or used in egg-breaking contests. The Jews have eggs at the *Passover Feast*.

**Easter Island**, or **Rapanui** (discovered by the Dutch Admiral Roggeveen, on Easter, 6th April, 1722), an island, 12 miles long, in the South Pacific Ocean, long. 100° 17' w., lat. 27° 0' s., and utilized for grazing sheep and cattle. It now belongs to Chile, from which it is 2000 miles distant. Pop. 250 in 1916. The Routledge Expedition reported, in 1919, that the inhabitants are of mixed Polynesian and Melanesian origin. Their ancient bird-cult shows very close resemblances to that of the Solomon Islands. Numerous gigantic stone images of a soft 'volcanic ash' were being worshipped when the island was first visited by Europeans in the eighteenth century. Some still lie partly constructed in a crater quarry. These images date back a few centuries, and resemble those made until recently in wood on this island and elsewhere in Oceania, and bear symbols used on these and in tattooing. Local legends of the earliest settlements from distant islands and of local tribal wars still survive. The present inhabitants are undoubtedly descendants of the image-makers and worshippers. Cf. K. Routledge, *The Mystery of Easter Island*.

**Eastern Bengal and Assam**, a province of India, under a Lieutenant-Governor, formed in 1905 by disjoining from Bengal the three divisions of Chittagong, Dacca, and Rajshahi (with the exception of Darjeeling) and uniting Assam with them, as also the state of Cooch Behar. It was formed in order to provide for the better government both of the area belonging to it and of that of Bengal, which was regarded as having become rather unwieldy, its population being still 54 millions. On 1st April, 1912, however, Assam was separated from Eastern Bengal and reconstituted. Its area is about 53,000 sq. miles, and the pop. nearly 6,750,000.

**Eastern Churches**, a collective term for the Greek, Armenian, Coptic, Abyssinian, Syrian, and other kindred Churches, as distinguished from the Latin, or Western Church.

**Eastern Question**, The, an international political problem which occupied the attention of European statesmen during the last two centuries, and even since 1453, when the Turks established their empire and gained sway over the Balkans. It deals with the relations of the Balkan nationalities, Turkey, and the Great Powers to each other. Russia, Germany, Austria, Greece, France, Italy, and Great Britain were all interested in the Near East and in the Eastern Question ever since the Treaty of Kutahuk-Kainardji in 1774. The Levantine commerce and the Mediterranean ports were, and still are,



of vital importance not only to Russia, but also to the Balkan States and to the neighbouring European powers. The occupation of Egypt by Great Britain, the Russo-Turkish War of 1878, the proclamation of Bulgaria's independence, the annexation of Bosnia and Herzegovina by Austria in 1908, all contributed to the complication of the Eastern Question. This complication was further increased by Italy's occupation of Tripoli in 1911, by the Balkan Wars (1912-8), and by the construction of the Bagdad Railway with the aid of German capital. It is no exaggeration to say that the Eastern Question was one of the causes which led to the outbreak of the European War of 1914. The Peace Treaties of Versailles, Sèvres, and St. Germain have not yet settled the Eastern Question, and the peace in the Near East is still a problem which occupies the attention of European diplomatists.—BIBLIOGRAPHY: W. A. Phillips, *Modern Europe*; R. W. Seton Watson, *The Rise of Nationality in the Balkans*.

**Eastern Rumelia.** See *Bulgaria; Rumelia*.

**Easter Term,** one of the four regular terms of the courts of common law in England, beginning on the 10th April, and continuing till the middle or end of May.—In Oxford University, a term beginning 13th April, ending 27th May; in Cambridge, beginning 18th April, and ending 24th June.

**East India Company,** a great English company, originally simply a trading association, which played an important part in the history of Hindustan. It was formed in 1599 in London, with a subscribed capital of about £30,000, for the purpose of trade with the East Indies. A charter was granted to it by Queen Elizabeth on 31st December, 1600, for fifteen years, renewable for a similar period. In this charter the Company is styled, "The Governor and Company of the Merchants of London trading into the East Indies". The first voyages resulted in large profits. In 1609 the charter was renewed by James I, and made perpetual, reserving power to the Crown to recall it at three years' notice. Additional power was granted to the Company of seizing and confiscating ships and goods of contraband traders, either in the British dominions or in any of the places where they were authorized to trade. Among the motives which had induced the Company to press for this renewal of their charter was the necessity they had experienced from the jealousy of the Dutch and Portuguese to send out vessels fitted not only for trade, but for defence and indeed attack. Accordingly Captain Best, who commanded the eighth expedition, attacked four Portuguese war galleons, convoying 200 sail of merchantmen, off Surat, and gained a complete victory, which so impressed the Great Mogul

that he immediately made a treaty with Captain Best, giving the English full liberty to trade in his dominions. This treaty was concluded on 6th Feb., 1613. It was followed at once by a resolution of the Company to trade on a joint-stock. £429,000 was raised as capital, and apportioned in fitting out four voyages for 1613, 1614, 1615, 1617. In 1617 and 1618 the Company was so enlarged as to include 954 proprietors, while a new joint-stock of £1,600,000 was subscribed. In 1619 a treaty was made with the Dutch, by which the two companies were to work in harmony for twenty years; but in 1623 the Dutch massacred the leading members of the English factory at Amboyna. In the feeble reigns of James and Charles I, however, the outrage remained unredressed, and the English Company, ill supported by the Crown, was often reduced to great straits. Their trade, impeded by the Dutch, became unprofitable, and, to add to their difficulties, Charles I in 1635 gave a licence to a Dutch company. At length, under Cromwell, the Company received a new charter. A territorial footing had been acquired in Madras in 1640, to which settlement was given the control of all the factories in Bengal and the Coromandel coast, the Supreme Council in India still remaining at Surat. A new charter, granted by Charles II in 1680, enlarged the powers of the Company, giving it political and judicial authority in the factories and colonies established by it, with the right to appoint governors. On the Revolution of 1688 the Company was involved in new difficulties, and in 1692 the Commons presented an address to the Crown praying for their dissolution. At this time, by an accidental failure to pay a tax upon their stock, the Company formally forfeited their charter, and were compelled to accept its renewal with the important proviso of a reservation to the Crown of the right to alter or modify its conditions. The maximum stock to be held by any individual was fixed at £10,000, every £1000 of which was to give a vote, while the right of membership was thrown open to all British subjects. The Scottish Parliament also sanctioned a company, but a war with Spain and the bitter opposition of the English Parliament made difficulties under which this company succumbed. Meantime the misconduct of the English company had so strengthened its enemies that, in spite of all its opposition, a resolution in favour of the formation of a new company passed the House of Commons on 4th May, 1698, and this company was actually constituted by Act 9 William III cap. xlv. This Act provided for the extinction of the old company, but an amalgamation was eventually arranged in 1708. The possessions of the old company at the time of amalgamation, upon which the valuation of £330,000 was placed

in 1700, included a large number of places in India, a footing having been by this time acquired in each of the three presidencies, besides possessions in Persia, Cochin-China, and Sumatra. The dividends of the Company rose rapidly after the amalgamation, and finally settled at 8 per cent; and it procured without difficulty, at various periods, a prolongation of its exclusive privileges until 1780, still with three years' notice. In the meantime the French possessions had, as well as the English, been growing in power and importance in the East, and on the outbreak of the war of the Austrian Succession in 1741 commenced those struggles (Clive being the first great English leader) by which a mercantile company was led on to establish British supremacy over nearly the whole of India. In 1760 the right of the Company to acquire territorial possessions formed a subject of parliamentary inquiry; and the question of the political rights of the Company being thus opened up, the ministry began to act on their views by sending out a Crown plenipotentiary to India. A regulating Act was passed in 1773 re-organizing the constitution of the Company, and placing it completely under the control of Parliament, providing for the establishment by the Crown of courts of judicature in India. The charter, which expired in 1780, was renewed till 1791. The Renewal Act provided that the Company, which was authorized and to submit to the Government all dispatches received from India, should submit for approval all dispatches proposed to be transmitted thither. In 1784 another Act established a board, afterwards known as the Board of Control, to superintend, direct, and control all acts, operations, and concerns relating to the civil and military government or revenues of India. The board was to consist of a principal Secretary of State, the Chancellor of the Exchequer, and four Privy Councillors nominated by the Crown. The directors of the Company were bound to submit all their papers except those referring to commercial matters to this board, and obey its instructions. From this time the political power of the Company was little more than nominal. While the right of nominating the servants of the Company was still left to the directors, the absolute right of recall was vested in the Crown. A subsequent Declaratory Bill regulated the power of the Board of Control to send out troops at the expense of the Company. In 1813 the charter was renewed on condition that the right of exclusive trade should be restricted to China, while the India trade should be thrown open to all British subjects. A Church establishment for India was also provided by this Act. The appointment of governors-general, governors, and commanders-in-chief was no longer to be valid without the direct sanction of the Crown.

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The renewal of the Company's charter in 1834 took place amid continued opposition to their mercantile, and even to their legislative privileges. It continued them in all their possessions except the island of St. Helena, put an end to the exclusive right of trade with China, and enacted that the Company should with all convenient speed close their commercial business, and make sale of all their property not retained for Government purposes; all their other property was to be held in trust for the Crown, which was to take over their debts and guarantee their dividend out of the revenues of India. The stock was valued at £6,000,000, which was to bear interest at 10 per cent, and be redeemable after 30th April, 1874, on payment of £12,000,000. The Company was now fairly in liquidation, and on the outbreak of the mutiny of 1857 it was felt indispensable to vest the government of India directly in the Crown, and this was accordingly



Silver Rupee of East India Company, 1675

done in 1858. Henceforth the Company existed only for the purpose of receiving payment of its capital, and of the dividends due upon capital until its repayment.—BIBLIOGRAPHY: J. Bruce, *Annals of the East India Company*; Sir W. W. Hunter, *History of British India*; W. Cunningham, *Growth of English Industry and Trade in Modern Times*; J. Macpherson, *The History and Management of the East India Company*; W. Foster and F. C. Danvers, *Letters received by the East India Company from its Servants in the East* (6 vols.).

**East Indies**, the name loosely applied to all India, the Indo-Chinese peninsula, and a portion of the Eastern Archipelago, but excluding the Philippine Islands, New Guinea, and Australia.

**Eastlake**, Sir Charles Lock, English painter, president of the Royal Academy, born at Plymouth 17th Nov., 1793, died at Pisa 23rd Dec., 1865. He studied at the Royal Academy, London, and at Paris. In 1817 he visited Italy and Greece, and painted besides other pictures his *Pilgrims arriving in Sight of Rome*. In 1880 he was elected member of the Royal Academy, and in 1850 became its president, receiving at the same time the honour of knighthood. From 1843 to 1847 he was keeper of the National Gallery, of which he was afterwards director for

about ten years. Sir Charles is also known as a writer on art by his *Materials for a History of Oil-painting*. Among his most noteworthy pictures are: *Lord Byron's Dream* (in the Tate Gallery), *Greek Fugitives*, *Escape of the Carrara Family*, *Christ blessing Little Children*, *Christ lamenting over Jerusalem*.

**East London**, a seaport on the east coast of Cape Province, at the mouth of the Buffalo River, now an important outlet for the produce of this region, connected by railway with Cape Town. Pop. 20,867.

**East Main**, a considerable river of Canada, having a westward course to James Bay, the southern extension of Hudson Bay, and forming the boundary between Quebec province and Ungava territory.

**Easton**, a city of Pennsylvania, United States, at the junction of the Delaware and Lehigh Rivers, 75 miles s.w. of New York. It contains iron-foundries, tanneries, and breweries. Pop. 32,000.

**East River**, a strait in New York State, separating New York from Brooklyn and connecting Long Island Sound with New York Bay, about 20 miles long. The Brooklyn Bridge, and the Williamsburg, Queensboro, and Manhattan Bridges now cross the river.

**East St. Louis**, a town of the United States, in Illinois, on the east bank of the Mississippi, opposite St. Louis, and connected with it by a great steel arch bridge and another bridge, carrying numerous lines of railway. Pop. 58,547.

**Eastwood**, a town of England, in Notts, on the Derbyshire border, with coal-mines, 8½ miles w.n.w. of Nottingham. Pop. 4692.

**Eau** (ô), a French word signifying *water*, and used in English with some other words for several spirituous waters, particularly perfumes, as *eau de Cologne*, and *eau de Luce*.—*Eau de Cologne* is a fragrant water, made originally and in most perfection in Cologne by a manufacturer named Farina, by whose successors the only genuine water is said still to be manufactured. It consists of spirits of wine flavoured by different essential oils blended so as to yield a fine fragrant scent. It was invented in Northern Italy by one of the Farina family, who afterwards settled in Cologne.—*Eau Cr  le*, a highly esteemed liqueur made in Martinique by distilling the flowers of the mamme   apple with spirit of wine.—*Eau de Luce* ('water of Luce'), so called from the name of its inventor, is made by dissolving white soap in spirit of wine, and adding oil of amber and sal ammoniac. It is a milky fluid, antispasmodic and stimulant.—*Eau de Vie* ('water of life'), a term used by the French for the coarser kinds of brandy, *cognac* being the name of the best.

**Eau Claire** (   kl  r), a city of Wisconsin,

United States, at the junction of the Eau Claire and Chippewa Rivers, a great lumbering centre. In 1910 Eau Claire adopted the commission form of government, being the first city in the state to do so. Pop. 18,310.

**Eaux-bonnes** (  -bon), a watering-place, France, department of Basses Pyr  n  es, about 25 miles south of Pau. The hot sulphur springs are said to have great efficacy in affections of the chest. Pop. 622.—Near it is *Eaux Chaudes*, also with warm springs.

**E'bal**, a mountain of Western Palestine about half-way between Jerusalem and Nazareth, on the north side of a narrow valley, on the south side of which and directly opposite stands Mt. Gerizim with Nablous almost between. Here the Israelites set up an altar on their entrance into the Holy Land and had the law solemnly read to them by Joshua (*Josh.* viii 30-35). At the east end of the valley are Jacob's Well and Joseph's Tomb.

**Ebbsfleet**, a hamlet in the Isle of Thanet, county Kent, memorable as the place where the first Anglo-Saxon invaders landed.

**Ebbw-vale**, a town of England, in Monmouthshire, with ironworks, steelworks, and collieries. Pop. 30,540.

**Ebena'cese**, a nat. ord. of gamopetalous Dicotyledons, consisting of trees and shrubs, of which the wood is very hard, and frequently of very dark colour in the centre, as ebony. The leaves are alternate, and generally coriaceous and shining; calyx gamosepalous and persistent, with three or six equal divisions; corolla with imbricated divisions. The fruit is a globular berry containing a small number of compressed seeds. The principal genus is *Diospyros*, which yields ebony and iron-wood.

**Ebers** (  b  rz), Georg Moritz, German Egyptologist and novelist, born 1st March, 1837, at Berlin, died in 1898. He studied at Gottingen, and afterwards at Berlin, where he devoted himself to Egyptology. In 1870 he was made professor at the University of Leipzig, but he had to resign in 1880. In 1869 and 1870 he travelled extensively in Egypt and Nubia. Two years later he again visited Egypt, where he discovered the medical papyrus, known as the *Papyrus Ebers*. His most important works have been translated into English, such as *Egypt, Descriptive, Historical, and Picturesque*; and the novels *An Egyptian Princess*, *Uarda*, *Homo Sum*, *The Emperor*, *The Sisters*, all dealing with old Egyptian life; *The Burgomaster's Wife*, and *Only a Word*.

**Eberswalde** (  b  rz-v  l-de), a town in Prussia, in the province of Brandenburg, on the Finow Canal, 27 miles north-east of Berlin. It has a school of forestry, piscicultural establishment, botanic gardens, well-frequented mineral springs,

and industrial works of various kinds. Pop. 26,064.

Ebert, Fritz, first President of the new German Republic, born at Heidelberg in 1870, the son of a tailor. Having received an elementary education in his youth, he first worked in his father's shop, and was then apprenticed to a saddler. He spent his spare time in reading and acquiring knowledge, entered journalism, and in 1892 became editor of the *Bremer Bürgerzeitung*. In 1908 he was elected to the Reichstag, and in 1918 became president of the Socialist group of this Assembly. He appealed for peace in the Reichstag in Sept., 1918, and having thus become rather prominent, he succeeded Prince Max of Baden as Chancellor of the Empire. The office was suppressed a few days later, and Ebert became Provisional President of Germany. He crushed the efforts made by the Spartacus group to prevent the elections for the National Assembly, and altogether showed tact and energy in those critical days. The National Assembly met at Weimar, and elected Ebert as first President of the Reich on 11th Feb., 1919. He died in 1925.

Ebionites (Heb. *ebionim*, poor), a sect of the first century, so called from their leader, Ebion. Irenæus described them as Jewish Christians. They held several dogmas in common with the Nazarenes, united the ceremonies of the Mosaic institution with the precepts of the gospel, and observed both the Jewish Sabbath and Christian Sunday. They denied the divinity of Christ and rejected many parts of the New Testament.

Eblis, or Ibils, in Mohammedan mythology, the chief of the evil spirits; also the name given to the prince of darkness, or Satan.

Eb'oli, a city of Campania, Southern Italy, a few miles from the Gulf of Salerno. Pop. 12,741.

Eb'ony, the popular name of various plants of different genera, agreeing in having wood of a dark colour. The best-known ebony is derived from plants of the genus *Diospyros*, nat. ord. Ebenaceæ. The most valuable is the heart-wood of *D. Ebenum*, which grows in great abundance in the flat parts of Ceylon, and is of such size that logs of its heart-wood 2 feet in diameter and from 10 to 15 feet long are easily procured. Other varieties of valuable ebony are obtained from *D. melanoxylon* of Coromandel, *D. tesseleri* of Mauritius, and other species. Ebony is hard, heavy, and durable, and admits of a fine polish or gloss. The most usual colour is black, red, or green. The best is jet black, free from veins, very heavy, astringent, and of an acrid pungent taste. On burning coals it yields an agreeable perfume, and when green it readily takes fire from its abundance of fat. It is wrought into toys, and used for mosaic and inlaid work.

Ebony Lore. In ancient times ebony was

a sacred wood. The Indians carved from it images of gods and drinking-cups. It was first used by the ancient Egyptians, who called it *heben*, and imported it from 'God-land' (Punt). The Hebrew name is *hobnim*, the Greek *ebenos*, the Hindi *ābanāsa*. Ezekiel (xxvii, 15) connects ebony with Tyre. The ebony displayed in Rome by Pompey in his triumph over Mithridates came, according to Solinus, from India. The Chinese call it *Wu-men* ('black-streaked wood'), and anciently imported it from India and Indo-China.

E'bro (Lat. *Ibērus*), one of the largest rivers in Spain, which has its source in the province of Santander, about 25 miles s. of the Bay of Biscay, and after a south-easterly course of about 500 miles enters the Mediterranean. Its navigation is much interrupted by rapids and shoals, to avoid which a canal about 100 miles long has been constructed nearly parallel to its course. Saragossa is the principal town on the river.

Écarté (ā-kār'tā), a card-game for two players, is played with thirty-two cards, the smaller ones, from two to six inclusive, not being used. The remaining cards rank as follows: king (highest), queen, knave, ace, ten, &c. In the English mode of playing, the players cut for the deal, which is decided by the lowest card. The dealer gives five cards to either player, three and two at a time, and turns up the eleventh card for trump. If he turns up a king he scores one; and if a king occurs in the hand of either player, the holder may score one by announcing it before the first trick. The non-dealer leads; trumps take all other suits, but the players must follow suit if they can. Three tricks count one point, five tricks two points; five points make game. Before play begins, the non-dealer may claim to discard (*écarté*) any of the cards in his hand, and to replace them by fresh ones from the pack. This claim the dealer may or may not allow. Should he allow it, he can himself discard as many cards as he pleases. Sometimes only one discard is allowed, sometimes more.—Cf. Cavedish, *The Laws of Écarté adopted by the Turf Club*.

Ecbat'ana, the chief city or ancient metropolis of Media, the summer residence of the Median and Persian and afterwards of the Parthian kings. It was a place of great splendour at an early period. Its site can no longer be fixed with certainty, though many explorers agree in identifying it with the modern Hamadan.

Ecce Homo (ek'sē; Lat., 'Behold the man!'), a name often given to crucifixes and pictures which represent Christ bound and crowned with thorns. The most celebrated of these paintings are by Sodoma, Correggio (in the National Gallery), Titian, Tintoretto, Guido Reni, and Murillo. The expression is derived from the words spoken by Pilate when he showed Christ

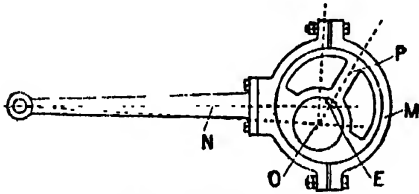
to the multitude before he was led forth to Crucifixion (*John*, xix, 5).

**Eccentric**, a term in mechanics applied to contrivances for converting circular into reciprocating (backwards and forwards) rectilinear motion, consisting of circular discs attached to a revolving shaft, not centrally, i.e. eccentrically.

**Ecchymosis** is extravasation of blood into the tissues underlying the skin. It is most frequently produced as the result of a bruise from injury, but may be due to some pathological condition.

**Ecclefechan** (ek-l-feh'an), a Scottish village in Dumfriesshire, near the Caledonian Railway main line, noteworthy as the birth-place and burial-place of Thomas Carlyle. Pop. 670.

**Eccles**, a town of England, in Lancashire, 4 miles from Manchester, of which it may be considered a suburb. The town, engaged in



Eccentric and Rod

P, Pulley. M, Strap. N, Rod. O, Centre of shaft. E, Centre of eccentric. O, E, Is the throw or radius of the eccentric.

textile industries, is famous for its cakes. Since 1918 it returns one member to Parliament. Pop. 41,940.

**Ecclesiastes** (-tēz), the title by which the *Septuagint* translators rendered the Hebrew *Kohleth* ('the gatherer of the people'), a symbolic name explained by the design of the book and the dramatic position occupied by Solomon in it, one of the canonical books of the Old Testament. The book consists of 12 chapters, being a series of discourses on the vanity of earthly things, and the tone, which is sceptical, is such as is found in Omar Khayyám. According to Jewish tradition, it was written by Solomon; but the best modern criticism has decided that its style and language, no less than its thought, belong to a much later date.

**Ecclesiastical Commissioners**, in England, a body corporate, constituted in 1836, with extensive powers in regard to the organization of the Church, the distribution of episcopal duties, and the formation of parishes. It consists of all the bishops of England and Wales, five cabinet ministers, four judges, and twelve others. Their decisions are ratified by orders in council, and acquire the force of Acts of Parliament. The Commissioners deal with an annual income of about 2 million pounds.

**Ecclesiastical Courts**, courts in which the canon law is administered and which deal with ecclesiastical cases, affecting benefices and the like. In England they are the *Archdeacon's Court*, the *Consistory Courts*, the *Court of Arches*, the *Court of Peculiars*, the *Prerogative Courts* of the two archbishops, the *Faculty Court*, and the *Privy Council*, which is the court of appeal, though its jurisdiction may by Order in Council be transferred to the new Court of Appeal. No separate ecclesiastical courts existed in England before the Norman Conquest, but by a charter of William I a distinction was made between courts civil and courts ecclesiastical. In Scotland the ecclesiastical courts are the *Kirk-session*, *Presbytery*, *Synod*, *General Assembly* (which is the supreme tribunal as regards doctrine and discipline), and the *Teind Court*, consisting of the judges of the Court of Session, which has jurisdiction in all matters affecting the teinds of a parish. In the Isle of Man ecclesiastical courts still have, as formerly in England, jurisdiction in probate and matrimonial cases.

**Ecclesiastical Law** may, in the broad sense of the term, be taken to include the regulations existing in any Church or sect, however small, for the formation of its own polity and for the control of its members. It is, however, more generally applied to those legal bonds which exist between Established Churches and the State. The Roman Catholic Church claims to be the one and only true Church, regards her laws as being of universal application, and herself as an equal with the State; nevertheless she has, in non-Catholic countries, no higher legal standing than any small and obscure dissenting congregation, and is in this respect a 'free' Church. Protestant ecclesiastical law claims no such sovereign power, and in no way interferes with the State law. In England the Convocations of York and Canterbury have no authority to change the law, their power being limited to the making of recommendations. All changes in Church law are made by Parliament. Laymen can be, and often are, officials of the ecclesiastical courts. The civil law is subject to the canon law, above which is the common law, with, yet higher, statute law. Over all is the nominal supremacy of the Crown. Ecclesiastical law deals with such affairs and property of the Church of England as ecclesiastical parishes, churches, and matters matrimonial; but only so far as these are not controlled by common or statute law. It has long ceased to have any practical control of the laity. In Ireland, ecclesiastical law disappeared with the disestablishment of the Church.

**Ecclesiasticus**, a book placed by Protestants and Jews among the apocryphal scriptures. The author calls himself Jesus the son of Sirach.

Originally written in Hebrew, it was translated into Greek by the author's grandson in the second century B.C. In 1896 fragments of four MSS. in the Hebrew original were discovered in the *Geniza*, or hiding-place for worn out copies of biblical books, in the synagogue at Cairo. Another fragment was discovered in Palestine by Mrs. Agnes Lewis.—Cf. Schechter and Taylor, *The Wisdom of Ben Sira: Portions of the Book Ecclesiasticus*.

Échelles, Les (lā-zā-shāl; 'the Ladders'), a village, France, department of Savoie, 12 miles south-west of Chambéry, in a valley from which egress at one end was formerly by means of ladders, but now by a tunnel. Pop. 798.

Échelon (esh'e-lon), a formation of successive and parallel units facing in the same direction, each on a flank and to the rear of the unit in front of it.

Echeneis, the type genus of a small family (Echeneididae) of aberrant spiny-finned fishes, in which the first dorsal fin is modified into a transversely ridged suction disc. See *Remora*.

Echeveria (ech-e-vē'ri-a), a genus of succulent plants, ord. Crassulaceae (house-leek), chiefly natives of Mexico, but now cultivated in European and other gardens and greenhouses, some for their flowers, others for their foliage.

Echidna (ē-kid'na), a genus of Australian toothless mammals, in size and general appearance resembling a large hedgehog, excepting that the spines are longer and the muzzle is protracted and slender, with a small aperture at the extremity for the protraction of a long flexible tongue. The habits of the Echidna are nocturnal; it burrows, having short strong legs with five toes, and feeds on insects, which it catches by protruding its long sticky tongue. It is nearly allied to the Ornithorhynchus, the two forming a peculiar class of animals, having in their structure some peculiarities at once of mammals, birds, and reptiles. In 1884 it was found that, as Geoffrey St. Hilaire had suspected, the Echidna, the closely related Proechidna of New Guinea, and the Ornithorhynchus constitute the lowest sub-class of mammals, the Prototheria or Monotremata, which present many reptilian characters. They possess a cloaca into which the intestine and urinogenital ducts open and are oviparous. During the breeding season a temporary pouch is formed, and into this the milk-glands open, but there are no teats. The egg when laid is put into the pouch by the mother, and is there hatched in a very immature state. It feeds by licking up the milk in the pouch. Later on, the mother digs a burrow, where she leaves the young at night, returning during the day to suckle it. One species (*E. hystrix*), from its appearance is popularly known as the *porcupine ant-eater*.

Echinocactus (e-ki'-), a genus of cactaceous plants inhabiting Mexico and South America, and remarkable for their peculiar forms, being globular, oblong, or cylindrical, and without leaves, fluted and ribbed, with stiff spines clustered on woolly cushions. Some of them are very bulky. The flowers are large and showy. See *Cactus*.

Echinococcus, the very large compound cyst which forms the bladder-worm stage in the life-history of a small tapeworm (*Tania echinococcus*) living in the intestine of the dog. The cysts are found in various abdominal organs of herbivorous animals, and sometimes infest human beings, especially in Iceland.

Echinodermata (e-ki-nō-dēr'ma-ta), a phylum or sub-kingdom of invertebrate animals characterized by having a tough integument in which lime is deposited in scattered plates (sea-cucumber), flexibly articulated plates (star-fishes), or so as to form a rigid test or shell like that of the sea-urchin; and by the radial arrangement of many of the parts of the adult. Movable spines are commonly present. There is a system of tubes into which seawater is admitted (ambulacral system), and commonly tube-feet, that are put into use by being distended with fluid. Some of them, as the encrinites or scallies, are permanently fixed by a stalk when adult. Their development is accompanied by metamorphosis, and the embryo shows a distinctly bilateral aspect, though the radiate arrangement prevails in the adult. By some they are classed with the Scolecida in the sub-kingdom Annuloida. The phylum is divided into nine classes: Asteroidea (star-fishes); Ophiuroidea (brittle-stars), Echinoidea (sea-urchins), Holothuroidea (sea-cucumbers), Crinoidea (scallies, feather-stars, the latter free-moving), Thecoidea or Edrioasteroidea (extinct, stalkless but fixed), Carpoidea (extinct, stalked), Cystoidea (extinct, stalked), Blastoidea (extinct, stalked). All are marine.

Echinomys, or Spiny Rat, a genus of South American rodent mammals distinguished by the presence of spines among the coarse fur. The long tail is covered by scales and hair intermixed, the ears are large, and all the extremities possess five digits.

Echinus (e-ki'nus), Sea-urchin, or Sea-egg, a genus of marine animals, the type of an order (Echinoidea) of the phylum Echinodermata (see above). In this type the body is spheroidal and invested in a test or shell composed of regularly arranged plates closely united together. It is covered with movable spines articulated by ball-and-socket joints. The mouth is situated in the centre of the under surface, and there is a complicated masticatory apparatus (Aristotle's lantern) consisting of five chisel-ended teeth



supported by an elaborate framework. The anus is similarly placed on the upper side, and is surrounded by a circlet of ten plates (apical disc), one of which bears a furrowed tubercle (madreporite) perforated by small holes through which water enters the water-vascular system. Locomotion is effected by meridional rows of tubefeet, aided by the spines. *E. esculentus* and some other species are edible. See *Sea-urchin*.

*Echinus* (e-kl'nus), in architecture, the *ovolo* or quarter-round convex moulding, seen in



Echinus

capitals of the Doric order. It is especially frequently found curved with the egg-and-dart ornament.

**Echo** (ek'ō), the repetition of a sound caused by the reflection of sound-waves from some surface, as the wall of a building. The echo may, however, be very distinct when the reflecting surface is very irregular, and it is probable that the resonance of the obstacles and the masses of air which they enclose contribute in producing the echo. The waves of sound on meeting the surface are turned back in their course according to the same laws that hold for reflection of light. In order that the echo may return to the place from which the sound proceeds, the reflection must be direct, and not at an angle to the line of transmission, otherwise the echo may be heard by others but not by the transmitter of the sound. This may be effected either by a reflecting surface at right angles to the line of transmission, or by several reflecting surfaces which in the end bring the sound back to the point of issue. Sound travels about 1125 feet in a second; consequently, an observer standing at half that distance from the reflecting object would hear the echo a second later than the sound. Such an echo would repeat as many words and syllables as could be heard in a second. As the distance decreases, the echo repeats fewer syllables till it becomes monosyllabic. The most practised ear cannot distinguish in a second more than from nine to twelve successive sounds, so that a distance of not less than 60 feet is needed to enable an average ear to distinguish between the echo and the original sounds. At a near distance the echo only clouds the original sounds, and this often interferes with the hearing in churches and other large buildings. Woods, rocks, and mountains produce natural echoes in every variety, for which particular localities have become famous.

**Echo**, in Greek mythology, a mountain nymph (one of the Oreads). Legend relates that by her talking she detained Hera, when the latter

sought to surprise Zeus among the mountain nymphs. To punish her the goddess deprived her of speech, unless first spoken to. She subsequently fell in love with Narcissus, and because he did not reciprocate her affection she pined away until nothing was left but her voice.

**Echuca** (e-chō'ka), an Australian town, colony of Victoria, on the Murray, over which is an iron railway and roadway bridge, connecting it with Moama in New South Wales; trade (partly by the river) in timber and wool. Pop. 4187.

**Écija** (ā-thē-hā), an ancient town of Southern Spain, province of Seville, on the Genil, with manufactures of textile fabrics and a good trade. It is one of the hottest places in Spain. Pop. 23,217.

**Eck**, Johann Maier von, the celebrated opponent of Luther, born in 1486, died in 1543. Having obtained a reputation for learning and skill in disputation, he was made doctor of theology, canon in Eichstädt, and pro-chancellor of the University of Ingolstadt. He went to Rome in 1520, and returned with a Papal bull against Luther, in attempting to publish which he met with violent popular opposition. In 1530, while at the Diet of Augsburg, he made the remarkable admission that he could confute the Augsburg Confession by the fathers but not by the Scriptures. Eck was present also at the Diets of Worms (1540) and Ratisbon (1541).

**Eck'ermann**, Johann Peter, German writer, born in 1792, died in 1854. In 1813 he served in the army against the French, and was afterwards appointed to a small governmental post. He finally settled in Weimar, where he became private secretary to Goethe. After Goethe's death he published his *Conversations with Goethe*, a book which has been translated into all European languages.

**Eckmühl** (ek'mül), a village of Bavaria, circle of Lower Bavaria, on the Gross Laber, 13 miles s.e. of Ratisbon, the scene of a sanguinary battle between the French and Austrians on 22nd April, 1809, in which the latter were defeated.

**Eclampsia**, a medical term applied to convulsions that seem to be of an epileptic character, but differ from true epilepsy as being due to some special poison. The use of the term is now practically restricted to puerperal eclampsia, convulsions occurring in pregnant women, generally those suffering from kidney disease.

**Eclectics** (Gr. *eklektikos*, select) is a name given to all those philosophers who do not follow one system entirely, but select what they think the best parts of all systems. The system is called *eclecticism*. In ancient philosophy Cicero was the most conspicuous representative of eclecticism, and in modern times the eclectic

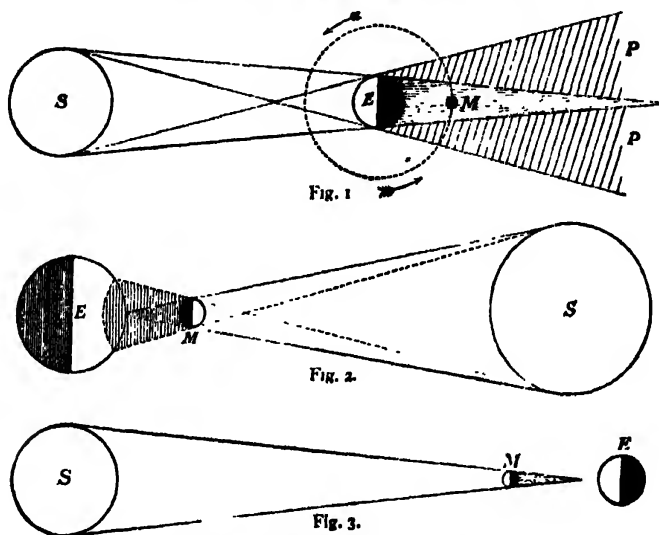


method found a notable supporter in the French philosopher Victor Cousin.

Eclipse (ek-lips'; Gr. *ekleipsis*, a falling, *ekleipō*, I fall), an interception or obscuration of the light of the sun, moon, or other heavenly body by the intervention of another and non-luminous body. A star or planet may be hidden by the moon; in this case the phenomenon is called an occultation.

An *Eclipse of the Moon* is an obscuration of the light of the moon occasioned by an interposition of the earth between the sun and the moon; consequently, all eclipses of the moon happen at full moon. Further, the moon's

whole or part of the face of the sun, occasioned by an interposition of the moon between the earth and the sun; thus all eclipses of the sun happen at the time of new moon. Fig. 2 is a diagram showing the cause of a solar eclipse. The dark or central part of the moon's shadow, where the sun's rays are wholly intercepted, is here the *umbra*, and the light part, where they are only partially intercepted, is the *penumbra*; and it is evident that if a spectator be situated on that part of the earth where the umbra falls, there will be a total eclipse of the sun at that place; in the penumbra there will be a partial eclipse, and beyond the penumbra there will be



Diagrams illustrating the Theory of Eclipses

direction from the earth must make only a very small angle with the axis of the earth's shadow, or line joining centres of sun and earth produced. But as the moon's orbit makes an angle of more than  $5^\circ$  with the plane of the ecliptic, it frequently happens that though the moon is in opposition it does not come within the shadow of the earth. The theory of lunar eclipses will be understood from fig. 1, where s represents the sun, e the earth, and m the moon. If the sun were a point of light, there would be a sharp outlined shadow or *umbra* only, but since the luminous surface is so large there is always a region in which the light of the sun is only partially cut off by the earth, which region is known as the *penumbra* (p p). Hence during a lunar eclipse the moon first enters the penumbra, then is totally or partially immersed in the umbra, then emerges through the penumbra again.

An *Eclipse of the Sun* is an obscuration of the

no eclipse. As the moon is not always at the same distance from the earth, and as the moon is a comparatively small body, if an eclipse should happen when the moon is so far from the earth that her shadow falls short of the earth, a spectator situated on the earth in a direct line with the centres of the sun and moon would see a ring of light round the dark body of the moon. Such an eclipse is called *annular*, as shown in fig. 3; when this happens, there can be no total eclipse anywhere. An eclipse can never be annular longer than 12 minutes 24 seconds, nor total longer than 7 minutes 58 seconds. The longest possible entire duration of an eclipse of the sun is a little over 4 hours.

An eclipse of the sun begins on the western side of his disc and ends on the eastern; and an eclipse of the moon begins on the eastern side of her disc and ends on the western. The largest possible number of eclipses in a year is seven.

four of the sun and three of the moon, or five of the sun and two of the moon. The smallest is two, both of the sun. But a solar eclipse affects only a limited area of the earth, while a lunar eclipse is visible from more than a terrestrial hemisphere, as the earth rotates during its progress. Therefore at any given place eclipses of the moon are more frequently visible than those of the sun.—BIBLIOGRAPHY: R. Buchanan, *The Theory of Eclipses*; W. T. Lynn, *Remarkable Eclipses*.

Ecliptic, the sun's path, the great circle of the celestial sphere, in which the sun appears to describe his annual course from west to east—really corresponding to the path which the earth describes. (See *Earth*.) The Greeks observed that eclipses of the sun and moon took place near this circle; whence they called it the *ecliptic*. The ecliptic has been divided into twelve equal parts, each of which contains 30°, and which are occupied by the twelve celestial signs, viz.:

- ♈ Aries (the Ram), 21st March.
- ♉ Taurus (the Bull), 20th April.
- ♊ Gemini (the Twins), 21st May.
- ♋ Cancer (the Crab), 21st June.
- ♌ Leo (the Lion), 23rd July.
- ♍ Virgo (the Virgin), 23rd Aug.
- ♎ Libra (the Balance), 23rd Sept.
- ♏ Scorpio (the Scorpion), 23rd Oct.
- ♐ Sagittarius (the Archer), 22nd Nov.
- ♑ Capricornus (the Goat), 22nd Dec.
- ♒ Aquarius (the Water-carrier), 20th Jan.
- ♓ Pisces (the Fishes), 19th Feb.

These are also called signs of the *zodiac*, the zodiac being a belt of the heavens extending 9° on each side of the ecliptic. The days of the month annexed show when the sun, in its annual revolution, enters each of the signs of the zodiac. From the First Point of Aries, or the place of the sun at the vernal equinox, the degrees of the ecliptic are counted from west to east. The plane of the ecliptic is that by which the position of the planets and the latitude and longitude of the stars are reckoned. The axis of the earth is not fixed in direction in space, but performs a slow conical motion about the pole of the ecliptic in about 26,000 years. In consequence of this the points at which the equator intersects the ecliptic, viz. the First Point of Aries and First Point of Libra, recede westwards upon the ecliptic at the rate of about 50 seconds a year. The signs of the zodiac, therefore, do not now coincide, as they did some 2000 years ago, with the constellations of the same names, and the First Point of Aries has now regressed through the greater part of the constellation Pisces. The angle at which the

ecliptic and equator are mutually inclined is also variable, and has been diminishing for about 4000 years at the rate of about 50 seconds in a century. Laplace gave a theory to show that this variation has certain fixed limits, and that after a certain time the angle will begin to increase again. See *Precession and Nutation*.

Eclogue (ek'log), a term usually applied to what Theocritus called *idyls*—short, highly finished poems, principally of a descriptive or pastoral kind, and in which the loves of shepherds and shepherdesses are described. Eclogues flourished among the ancients (*Bucolics* of Virgil), and, under the name of pastorals, were fashionable in the sixteenth century, Spenser's *Shepherd's Calendar* being a good example. They were revived in the eighteenth century by Pope.

École des Beaux Arts ('School of Fine Arts'), the French Government school of fine arts at Paris, founded by Mazurin in 1648, and provided with an extensive staff of teachers. The competitions for the *grands prix de Rome* take place at this school. All artists between the ages of fifteen and twenty-five, whether pupils of this school or not, may compete, after passing two preliminary examinations. The successful competitors receive an annual allowance from the State for three or four years, two of which must be passed at Rome. The Palais des Beaux Arts, the home of the École, was begun in 1820 and finished in 1863.

École Normale Supérieure ('Superior Normal School'), a school at Paris for the training of those teachers who have the charge of the secondary education in France, founded by decree of the Convention in 1794, reorganized by Napoleon in 1808, and again in 1830 by the Government of Louis-Philippe. By the decree of 1903 the school forms part of the University of Paris. It maintains a hundred students and has a course of three years' duration.

École Polytechnique ('Polytechnic School'), a school in Paris established with the purpose of giving instruction in matters connected with the various branches of the public service, such as mines, roads and bridges, engineering, the army and the navy, and Government manufactures. It was founded in 1794, and is under the direction of the Minister of War. Candidates are admitted only by competitive examination, and have to pay for their board 1000 francs a year. The pupils who pass satisfactory examinations at the end of their course are admitted to that branch of public service which they select.

Ecology, or Œcology, the study of the relations of plants to their surroundings, a branch of plant geography.—BIBLIOGRAPHY: Horwood, *British Wild-flowers*; Tansley, *Types of British Vegetation*; Warming, *Ecology*.

Economics is the name applied, in sub-

stitution for the older one of political economy, to the scientific study of men in relation to the production, exchange, distribution, and consumption of wealth. The origin of both names lies in the analogy between provision for the needs of a household and for those of a State. To the former the term 'economy' was originally applied, as in Xenophon's treatise on the subject. But it was soon adopted to describe that branch of the art of government which dealt with public revenue and expenditure, and a matter intimately connected therewith, the enrichment of the community as a whole.

This conception of economics inspired all economic writings until late in the eighteenth century, a typical example being Thomas Mun's *England's Treasure by Foreign Trade* (1684), containing an exposition of the mercantile system which sought to increase natural wealth by regulation of the balance of trade. The treatment of economics as a science had its origin in the writings of the Physiocrats, a group of French philosophers of whom Quesnay (1694-1774) was the most prominent, and with whom Turgot (1727-81), the great minister of Louis XVI, held many doctrines in common. The Physiocrats argued that the wealth of the community was raised to the maximum, not by State regulation, but by entire freedom in the economic sphere. But the chief importance of the Physiocrats lay in their paving the way for Adam Smith (1723-90), who in 1776 published *The Wealth of Nations*, a book which has exercised profound and widespread influence on thought and action, and is still a leading authority on the subject. Adam Smith definitely retained the conception of economics as part of the art of government. "Political economy", he says, "proposes two distinct objects: first, to provide a plentiful revenue or subsistence for the people . . . and secondly, to supply the State or Commonwealth with a revenue sufficient for the public service. It proposes to enrich both the people and the sovereign." But the book is also largely occupied with an investigation of the production, distribution, and exchange of wealth when free from all regulation and restriction, together with a powerful indictment of such regulation. This doctrine of non-interference by the State came to be known as the *laissez-faire* doctrine, from a phrase used by Gournay, one of the Physiocrats. Mainly through Adam Smith's influence, it became the orthodox view of the State's relation to trade and industry. This meant that the aims of economics, in its older sense, were best achieved without State action at all; and, consequently, economics came to mean simply the study of what are in fact men's activities in relation to wealth. This conception is clearly

expressed in such writers as Ricardo (1772-1828), whose *Principles of Political Economy and Taxation* enunciates the theory of rent which has formed the basis of all subsequent reasoning on the subject, and states a theory of wages which gave colour to Karl Marx's doctrine of the exploitation of wage-earners by capitalists. It is also evident in the work of Nassau Senior (1790-1864), in the important *Principles of Political Economy* of John Stuart Mill (1806-73), and is most fully expressed by J. E. Cairnes (1823-75).

This conception has formed the basis of all modern economics, despite important differences in the method of treating material. The modern view of the matter is well stated by Dr. Alfred Marshall in his *Principles of Economics*, a most important contribution to the subject, which has exercised much influence. Economics he defines as "a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the rise of material requisites of well-being". The separation between economics and the investigation of social phenomena in general is not so rigidly maintained to-day as in the past. It is realized that men's activities in relation to wealth are affected by other than purely economic considerations, and that political, moral, religious, and aesthetic forces must be taken into account. At the same time, the science deals only with what is, and not with what ought to be done; and is therefore distinct from *ethics*, which is concerned with moral judgments. Of late years, interest in the application of ethical considerations to economic problems has increased considerably, using the conclusions of economic science as its material, mainly in connection with problems of distribution, especially wages. One of the most important of modern political movements, Socialism, makes a just distribution of wealth the keynote of its doctrines. In so far as man's conduct is studied in economics, the science is concerned with psychological considerations; but it is distinct from *psychology*, taking the principles thereof as data rather than establishing them as conclusions. The traditional arrangement of the subject matter of economics into the production, exchange, and distribution of wealth is still maintained; but in recent years consumption, the end of almost all man's productive activity, has received much attention, notably from W. S. Jevons (1835-82) and Marshall. Important conceptions in this connection are those of the *diminishing utility* to an individual or group of individuals of each successive increment of any commodity received beyond a certain point; and of *consumer's surplus*, measured by the difference between the

price a person pays for a thing and what he would pay rather than go without it. Any rigid distinction between the different branches of economics is, however, impossible. For example, all processes of exchange may be considered as part either of distribution or of production.

The central problem of economics is really that of how the exchange value of commodities and services is determined; since in this determination all the forces regulating production, distribution, and consumption are brought to a focus, and their action and interaction can be investigated. The study of value covers that of all forces affecting either the demand for or the supply of a commodity, including its cost of production. On the side of production, technical processes are not studied in detail, though some knowledge of them is indispensable; but matters common to all production are dealt with, such as the so-called *laws of increasing and diminishing return*, which are statements of the relation between the amounts of labour, land, and capital used in production, and the amount of product. Other questions considered are transport, markets of all kinds, banking, currency, finance, and trusts and combinations. The study of distribution includes the methods by which wages, interest and profits, and rent are determined; and since each of these is payment for a service (of labour, capital, and land respectively) it is really an aspect of the study of value. Distribution also covers such subjects as trade unionism, co-operation, and labour disputes. Economics also deals with public finance (including taxation), treating of the effects of different methods of collecting and expending the State revenue. In considering the above-mentioned subjects, the method of economics is strictly that of a science, in that it aims partly at a descriptive analysis of material, and partly at a statement of cause and effect. The laws of economics are, like other scientific laws, statements of tendencies. They are not laws such as the commands or prohibitions of the State, though they are often loosely referred to in this way. That economics should be able to generalize and to predict about the action of men is due to its dealing not with individuals, but with large groups, so that individual peculiarities can be neglected and the general characteristics of the group ascertained. It is in this connection that considerable controversy has arisen. The older writers on economics were mainly deductive in method, i.e. they took a few general principles, such as that every man follows his own interest and knows where that interest lies, and made certain assumptions, such as the existence of free competition; and on this basis worked out a group of principles which were sometimes quite unrelated to actual facts. This method

is undoubtedly a most powerful one, and of great value provided that the original assumptions are kept clearly in mind, and variations from them in a particular case allowed for in applying conclusions. But the unreality of some of its results produced a reaction, of which an early instance is the famous *Essay on the Principle of Population* by T. R. Malthus, published in 1798. This book inaugurated the rise of a school of economists who treated their subject from an inductive and historical point of view. The historians, who have been especially prominent in Germany, and of whom representatives are Roscher (1817-94), de Laveleye (1822-92), and Cliffe Leslie (1825-82), hold that economics should in the main be descriptive, and not attempt to formulate laws. The inductive school, of whom J. S. Mill is an important member, base their work upon more extensive investigation than the older writers, and constantly test their conclusions by reference to facts. Another important reaction against the early economists arose from the identification of the latter with the doctrine of *laissez-faire*. Alexander Hamilton (1757-1804) and Friedrich List (1789-1846) argued in favour of an extension of State activity, especially for the purpose of protecting industry against foreign competition, and may be considered the fathers of modern protectionist doctrine. In most modern treatment of economics, the deductive and inductive methods are employed side by side. The study of economic history has developed as a separate branch, but economists recognize that it provides them with much valuable material. Important recent developments in method are the increased use of statistics, made possible by their more widespread and careful compilation, and the application of mathematical methods to economic data. It is recognized that, with due care, many conceptions which are with difficulty expressed in words can be treated on mathematical lines to yield results of great service. In this work the researches of Italian writers, such as Pantaleoni and Pareto, are of conspicuous importance.—BIBLIOGRAPHY: A. C. Pigou, *Wealth and Welfare*; *Preferential and Protective Import Duties*; E. Cannan, *Wealth*; J. N. Keynes, *Scope and Method of Political Economy*; G. Cassel, *Nature and Necessity of Interest*; W. Smart, *Distribution of Income*; C. R. Fay, *Co-operation*; A. Andreades, *History of the Bank of England*; H. Levy, *Monopoly and Competition*; C. F. Bastable, *Public Finance*.

Écraseur is a wire loop or chain for amputating a growth suitably situated for such an instrument. The chain is passed round the base or pedicle of the growth, and gradually tightened by a screw till the growth falls off. Its application in surgery is limited.

**Ectocarpaceæ**, a family of Brown Algae, section *Phaeosporæ*. The typical genus is *Ectocarpus*, comprising small, branched, filamentous plants of salt or brackish water. According to the species, growth of the filaments may be apical, intercalary, or common to all cells, whereas among the more advanced members of the Brown Algae either apical or intercalary growth is characteristic of entire families. The gametes show every gradation from complete similarity (isogamy) to a condition like that of *Cutleria*.

**Ecuador** (ek-wà-dōr') (*Republica Del Ecuador*), a republic of South America, situated under the equator, whence it takes its name, between Peru and Colombia. It is of triangular shape, its base resting on the Pacific, but the boundaries between it and its neighbours are not very definitely fixed; estimated area, about 110,000 sq. miles. The state has still a boundary dispute with Peru, that with Colombia having been settled by treaty in 1917. The country is divided into fifteen provinces, one territory—'El Oriente'—and the Archipelago of Galapagos, officially called 'Colón'. It falls, as regards the surface, into three sections: the comparatively narrow and low-lying coast regions, the mountain region, and the extensive plains on the east. The mountain region is formed by a double range of snow-capped mountains—several of them active volcanoes—which enclose a longitudinal valley or tableland, with a breadth of 20 to 40 miles, and varying in elevation from 8500 to 13,900 feet. The most elevated of these mountains are, in the western range, Chimborazo, Pichincha, and Cotacachi, Chimborazo being 20,703 feet high. In the eastern range are Cayambe, Antisana, and Cotopaxi (19,500 feet). The cultivated land and the population of Ecuador lie chiefly in this elevated region, which extends along between the summits of the Cordillera, and may be considered as divided by transverse ridges or dikes into the valleys of Quito, Iambato, and Cuenca. The chief towns here are Quito, the capital, with a pop. of 70,000, Riobamba, and Cuenca, all situated at a height of 9000 feet or more above the sea. The chief ports of Ecuador are Guayaquil and Esmeraldas. The most considerable rivers, the Tigre, Napo, Pastaza, &c., belong to the basin of the Amazon; and some of them, notably the Napo, are navigable for long distances. On the western slope of the Andes the chief rivers are the Esmeraldas and the Guayaquil. Ecuador is comparatively poor in Mammalia; although various kinds of deer as well as tapirs and peccaries are found in the forests. Parrots and humming-birds are also numerous, but perhaps the most remarkable of the birds in Ecuador is the condor, which dwells on the slopes

of the Andes. Reptiles, including serpents, are numerous. The forests yield cinchona bark, caoutchouc, sarsaparilla, and vegetable ivory. The climate on the plains, both in the east and the west, is moist, hot, and unhealthy. In the higher regions the climate is rough and cold, but in great part the elevated valleys, as that of Quito, enjoy a delightful climate. Here the chief productions are potatoes, barley, wheat, and European fruits. In the lower regions are grown all the food-products of tropical climates, cocoa, coffee, and sugar. The foreign commerce is not large, the exports and imports being annually about £2,700,000 and £1,870,000 respectively. In 1919 the imports from Ecuador to the United Kingdom amounted to £1,257,350, and the exports to Ecuador to £373,340. Cocoa forms three-fourths (or more) of the whole export; the remainder is made up of tigua or ivory-nuts, rubber, straw hats, coffee, and gold. A little gold is mined, and Panama hats are made. The State recognizes no religion, but grants freedom of worship to all. A system of education was organized in 1897 and improved in 1912. There are three universities: the Central University, at Quito; the Guayas University, in Guayaquil; and the Azuay University, in Cuenca. There are schools for higher education and primary schools. The executive government is vested in a President elected for four years, who is assisted by a Council of State. The Congress is the legislative body, and consists of two Houses, one formed of Senators, two for each province, the other of Deputies, one for every 30,000 inhabitants, both elected by universal suffrage. The Congress has extensive privileges, and cannot be dissolved by the President. The seat of government is Quito. In 1920 both the revenue and expenditure amounted to nearly £2,000,000. The debt amounts to about £5,020,000. The monetary standard is gold, the gold *condor* of ten *sucre*s being equivalent to a sovereign. The metric system of weights and measures is the legal one. Railways and telegraphs have made little progress.—Ecuador at the time of the conquest of Peru by the Spaniards formed part of the great empire of the Incas. As the Presidency of Quito it was long included in the Vice-Royalty of Peru. From 1710 it became part of the Presidency of New Granada (or Santa Fé de Bogotá). In the revolutionary war against Spain, Ecuador, along with the neighbouring territories, secured its independence (1822), and was ultimately erected into a separate Republic in 1831. The present Constitution of the Republic was promulgated on 6th May, 1900. Of the present population, the aboriginal red race form more than half; the rest are negroes, mulattoes, mestizoes, a degenerate breed of

mixed negro and Indian blood, and Spanish Creoles or whites. The last-named are the chief possessors of the land, but are deficient in energy. Pop. (estimated) 2,000,000.—BIBLIOGRAPHY: F. Garcia-Calderon, *Latin America: its Rise and Progress*; C. R. Enock, *Ecuador*; T. H. Stabler, *Travels in Ecuador*.

**Ecumenical Council**, a general ecclesiastical council regarded as representing the whole Christian world or the universal Church; specially applied to the general councils of the early Christian Church, beginning with that of Nicæa in 325, and later to those of the Roman Catholic Church, of which the most recent was the Vatican Council at Rome in 1870.

**Ec'zema** is a skin eruption marked by the appearance of papules or vesicles and accompanied by irritation of the affected part, frequently very severe. The characteristic watery discharge of the disease is produced by the bursting of the vesicles. There is difference of opinion among dermatologists as to whether or not it is primarily caused by germs. Various predisposing causes, like digestive disturbances, anæmia, and nervous disorders are important factors in determining the course of the disease. Eczema may affect practically any part of the skin, but is most frequently seen on the scalp, ears, face, hands, nipples, armpits, and the genital regions.

**Ed'am**, a town of North Holland, near the Zuider Zee, 12 miles N.N.E. of Amsterdam, noted for its cheese markets; but 'Edam cheese' is mostly made elsewhere. Pop. 6023.

**Edda** (meaning 'great-grandmother'), the name given to two ancient collections of Icelandic literature, the one consisting of mythological poems, the other being mainly in prose. The first of these collections, called the *Elder* or *Poetic Edda*, was compiled in the thirteenth century, and discovered in 1643 by Brynjulf Sveinsson, an Icelandic bishop. For a long time an earlier date was given, the compiler being erroneously believed to have been Sæmund Sigfusson, a learned Icelandic clergyman, who lived from about 1050 to 1133. It consists of thirty-three pieces, written in alliterative verse, and comprising epic tales of the Scandinavian gods and goddesses, and narratives dealing with the Scandinavian heroes. These poems are now assigned to a period extending from the ninth to the eleventh century. The *Prose Edda*, or *Younger Edda*, presents a kind of prose synopsis of the Northern mythology; a treatise on the Scaldic poetry and versification, with rules and examples; and lastly a poem (with a commentary) in honour of Haco of Norway (died 1263). In its earliest forms this collection is ascribed to Snorri Sturluson, who was born in Iceland in 1178, and was assassinated there in 1241 on his

return from Norway, where he had been scald or court poet.—Cf. S. Bugge, *Home of the Eddic Poems*.

**Eddy**, Mary Baker, founder of Christian Science (q.v.), born at Bow, New Hampshire, United States, 16th July, 1821, died 3rd Dec., 1910. She was married three times, to Mr. Glover, Mr. Patterson, and Mr. Asa Gilbert Eddy, all of whom she survived. She began to teach her system of psychotherapeutics in 1866, and founded the first Christian Science Church in Boston in 1879. In 1881 she established the Metaphysical College at Massachusetts. Her works, besides *Science and Health with Key to the Scriptures*, include: *Unity of God, No and Yes, Pulpit and Press, The First Church of Christ, Christian Science versus Pantheism*.—Cf. G. Milmine, *Life of M. B. G. Eddy and the History of Christian Science*.

**Eddystone Lighthouse**, a lighthouse in the English Channel, erected to mark a group of rocks lying in the fair-way from the Start to the Lizard. The rocks are covered only at the flood. The first lighthouse was of wood, and built by Henry Winstanley in 1696. It was carried away in the storm of 1703. Another lighthouse, also of wood, was built in 1709 by Rudyerd, but was burned down in 1755. It was succeeded by one built by Smeaton between 1757 and 1759, a circular tower 85 feet high; but, as the foundations on which it stood became much weakened, a new structure, designed by Sir J. N. Douglass, was built between 1870 and 1882 on the neighbouring reef. Its light is visible 17½ miles.

**Edelweiss** (ä-dél-vîs; Ger., 'noble white'), *Leontopodium alpinum*, a composite plant inhabiting the Alps, and often growing in the most inaccessible places. Its flower-heads are surrounded by a spreading foliaceous woolly involucre, and its foliage is also of the same woolly character. It is not difficult to cultivate, but is apt to lose its peculiar woolly appearance.

**E'den** (Heb. *eden*, delight), the original abode of the first human pair. It is said to have had a garden in the eastern part of it, and we are told that a river went out of Eden to water this garden, and from thence it was parted into four heads, which were called respectively Pison, Gihon, Hiddekel, and Euphrates (Phrat), but this does not enable us to identify the locality. It was not the whole of Eden that was assigned to man for his first habitation, but the part towards the east, to which the translators of the Authorized Version have given the name of the Garden of Eden, and which Milton, in *Paradise Lost*, calls Paradise, that word (originally Persian) having in its Greek form (*paradeisos*) been applied to the Garden of Eden by the translators of the *Septuagint*.

**Eden**, a river in England, in Westmorland and Cumberland, falling into the Solway Firth after a course of 65 miles.—Also, a river in Fife-shire, Scotland.

**Edenta'ta** (ê-), or **Toothless Animals**, the name applied to a primitive order of mammals mostly native to the neotropical region, but also represented in South Africa and South Asia. The body is often covered by horny scales or bony plates, the digits are clawed, and the teeth either imperfect or absent altogether. I. New World forms.—(1) *Ant-eaters*. Toothless, with long narrow snout and protrusible tongue. Covered with dense fur. The great ant-eater (*Myrmecophaga jubata*) lives on the ground; the much smaller *Tamandua* and *Cycloturus* are arboreal. (2) *Sloths*. Toothed arboreal leaf-eaters, covered by coarse fur, and provided with very strong curved claws, by which they hang upside down from branches. The three-toed sloth (*Bradypus*) has three digits in the forelimb, the two-toed sloth (*Choloepus*) only two. (3) *Armadillos*. Burrowing forms protected by a strong carapace of bony plates, and possessing numerous imperfect teeth. (4) *Extinct types*. The so-called ground sloths were of large size, *Megatherium* being nearly as large as an elephant, and *Mylodon* not much smaller. *Glossodon*, allied to the latter, survived into the human period. *Glyptodon* resembled a gigantic armadillo. II. Old World forms.—(1) The *aard-vark* (*Orycteropus*) is a burrowing African form about the size of a pig, covered with coarse hair; long ears and snout; 20 imperfect grinding teeth. (2) *Scaly ant-eaters* or *pangolins* (*Manis*), native to South Africa and South Asia, are toothless forms not unlike the American ant-eaters in build, but the body is covered dorsally and laterally by large overlapping scales.

**Edes'sa**, the name of two ancient cities.—1. The ancient capital of Macedonia, and the burial-place of its kings, now *Vodhena*. It is probably the same as the still more ancient *Acge*. Philip II was murdered at Edessa in 330 B.C.—2. An important city in the north of Mesopotamia, which, subsequent to the establishment of Christianity, became celebrated for its theological schools. In 1098, in the first Crusade, Edessa came into the hands of Baldwin, but ultimately became part of the Turkish Empire. It is thought to be the modern *Urfa* or *Orfa*.

**Edfu**, or **Edfoo'** (ancient *Apollinopolis*), a village in Upper Egypt, province of Assouan, on the left bank of the Nile, with manufactures of cottons and pottery. Its ancient magnificence is attested by several remains, especially a temple, founded by Ptolemy Philopator (181-145 B.C.), the largest in Egypt after those of Karnak and Luxor. Pop. 12,594.

**Ed'gar** (*the Peaceful*), one of the most distinguished of the Saxon Kings of England, was the son of King Edmund I. He succeeded to the throne in 959, and managed the civil and military affairs of his kingdom with great vigour and success. In ecclesiastical affairs he was guided by Dunstan, Archbishop of Canterbury, and he was a great patron of the monks. He died in 975, and was succeeded by his son Edward the Martyr.

**Edgar Atheling**, grandson of Edmund Ironside and son of Edward the Outlaw, was born in Hungary, where his father had been conveyed in infancy to escape the designs of Canute. After the battle of Hastings, Edgar (who had been brought to England in 1057) was proclaimed King of England by the Saxons, but made peace with William and accepted the earldom of Oxford. Having been engaged in some conspiracy against the king, he was forced to seek refuge in Scotland, where his sister Margaret became the wife of Malcolm Canmore. Edgar subsequently was reconciled to William and was allowed to live at Rouen, where a pension was assigned to him. In 1097, with the sanction of William Rufus, he undertook an expedition to Scotland for the purpose of displacing the usurper Donald Bane, in favour of his nephew Edgar, son of Malcolm Canmore, and in this object he succeeded. He afterwards took part in Duke Robert's unsuccessful struggle with Henry I, but was allowed to spend the remainder of his life quietly in England.

**Edgehill**, a ridge in Warwickshire, England, 7 miles north-west of Banbury, where was fought a fierce but indecisive battle on 23rd Oct., 1642, between the Royalists under Charles I and the forces of the Parliament under the Earl of Essex.

**Edgeworth**, Maria, Irish novelist, born at Black Bourton, Oxfordshire, 1st Jan., 1767, died 22nd May, 1849, at Edgeworthstown. She was the daughter of Richard Lovell Edgeworth (1744-1817) of Edgeworthstown, County Longford, Ireland. Her first novel, *Castle Rackrent*, a tale of Irish life, published in 1800, immediately established her reputation. Her later works include: *Belinda*, *Moral Tales*, *Lenora*, *Popular Tales*, *Tales of Fashionable Life*, *Patronage*, *Harrington*, *Ormond*, and *Helen*, besides an *Essay on Irish Bulls*, and a work on *Practical Education*, largely based on Rousseau's *Emile*. Miss Edgeworth's characteristics are a simple and lucid style and considerable power of observation, but she was not a great creative artist.

**Ed'inburgh**, the metropolis of Scotland, and one of the finest as well as most ancient cities in the British Empire, lies within 2 miles of the south shore of the Firth of Forth. It is picturesquely situated, being built on three eminences



which run in a direction from east to west, and surrounded on all sides by lofty hills except on the north, where the ground slopes gently towards the Firth of Forth. The central ridge, which constituted the site of the ancient city, is terminated by the castle on the west, situated on a high rock, and by Holyrood House on the east, not far from which rise the lofty elevations of Salisbury Crags, Arthur's Seat (822 feet high), and the Calton Hill overlooking the city. The valley to the north, once the North Loch, but now drained and traversed by the North British Railway, leads to the New Town on the rising ground beyond, a splendid assemblage of streets, squares, and gardens. The houses here, all built of a beautiful white freestone found in the neighbourhood, are comparatively modern and remarkably handsome. The principal streets of the New Town are Princes Street, George Street, and Queen Street. From Princes Street, which is lined by fine gardens adorned with Sir W. Scott's monument and other notable buildings, a magnificent view of the Old Town with its picturesque outline may be obtained. The principal street of the Old Town is that which occupies the crest of the ridge on which the latter is built, and which bears at different points the names of Canongate, High Street, Lawnmarket, and Castle Hill. This ancient and very remarkable street is upwards of one mile in length, rising gradually with a regular incline from a small plain at the east end of the town, on which stands the palace of Holyrood, and terminating in the huge rock on which the castle is built, 437 feet above sea-level. The houses are lofty and of antique appearance. Amongst the notable buildings are the ancient Parliament House, since the Union the seat of the supreme courts of Scotland; St. Giles' Church or Cathedral, an imposing edifice in the later Gothic style, dating from the fourteenth century and carefully restored between 1870 and 1883; the Tron Church; Victoria Hall (where the General Assembly of the Established Church meets), with a fine spire; and also John Knox's House, besides some of the old family houses of the Scottish nobility and other buildings of antiquarian interest. From this main street descend laterally in regular rows numerous narrow lanes called *closes*, many of them extremely steep, and very few at their entrances more than 6 feet wide; those which are broader, and admit of the passage of carriages, are called *wynds*. In these and the adjacent streets the houses are frequently more than 120 feet in height, and divided into from six to ten stories, or *flats*, the communication between which is maintained by broad stone stairs, winding from the lowest part of the building to the top. In the Old Town the most remarkable public building is the castle, an extensive mass,

of which the oldest portion—and the oldest building in the city—is St. Margaret's Chapel, the private oratory of the Saxon princess Margaret, queen of Malcolm Canmore; another portion being a lofty range of old buildings, in a small apartment of which Queen Mary gave birth to James VI in 1566; while in an adjoining apartment are kept the ancient regalia of Scotland. Here is also the old Parliament Hall, restored during 1888 and 1889. The castle as a fortress contains accommodation for 2000 soldiers, and the armoury space for 30,000 stand of arms. An old piece of ordnance built of staves of malleable iron, cask fashion, and known as *Mons Meg*, stands conspicuous in an open area. The palace of Holyrood, or Holyrood House as it is more generally called, stands, as already mentioned, at the lower or eastern extremity of the street leading to the castle. No part of the present palace is older than the time of James V (1528), while the greater portion of it dates only from the time of Charles II. In the north-west angle of the building are the apartments which were occupied by Queen Mary, nearly in the same state in which they were left by that unfortunate princess. Adjoining the palace are the ruins of the chapel belonging to the Abbey of Holyrood, founded in 1128 by David I. On the south side of the Old Town, and separated from it also by a hollow crossed by two bridges (the South Bridge and George IV Bridge), stands the remaining portion of the city, which, with the exception of a few unimportant streets, is mostly modern. Besides the buildings already noticed, Edinburgh possesses a large number of important edifices and institutions, chief amongst which are the Royal Institution (accommodating the Royal Society and other bodies), a beautiful Grecian building; the National (Picture) Gallery, another fine building in the Greek style, the two buildings standing on a conspicuous site between East and West Princes Street Gardens; the National Portrait Gallery, a building due to private munificence and accommodating also the National Museum of Antiquities; the Museum of Science and Art; the Episcopal Cathedral of St. Mary's, one of the largest religious edifices of modern times; the university buildings, including those of the medical department, standing apart from the others; the infirmary buildings; the high school, register office, and others. Amongst the more prominent educational institutions are the university, the high school, the academy, the United Free Church New College, the Edinburgh School of Medicine (connected with the Royal College of Physicians and the Royal College of Surgeons), Medical College for Women, College of Agriculture, the Edinburgh Veterinary College, Fettes College, the Heriot-Watt College, normal schools, technical, com-

mercial, and other institutions, and endowed secondary schools. The Advocates' Library, the largest in Scotland, contains upwards of 550,000 printed volumes and 8000 MSS.; the university library, 200,000; the library of Writers to the Signet, 100,000. There is also a rate-supported public library in a building erected at the expense of the late Andrew Carnegie. Printing, book-binding, coach-building, type-founding, machine-making, the making of rubber goods, furniture-making, ale-brewing on a very large scale, and distilling are the principal industries. Edinburgh is the head-quarters of the book trade in Scotland, and the seat of the chief Government departments. It is a great resort of tourists and other travellers. On account of its picturesque and commanding situation and its literary fame, Edinburgh is often called the 'Modern Athens'. The origin of Edinburgh is uncertain. Its name is by many thought to be derived from Eadwinsburgh, the Burgh of Edwin, a powerful Northumbrian king of the early seventh century, who absorbed the Lothians in his rule. The town was made a royal burgh in the time of David I; but it was not till the fifteenth century that it became the recognized capital of Scotland, and from that time it was the scene of many important events in Scottish history. The city is now governed by a council, which elects from its members a Lord Provost, a city treasurer, and seven bailies. It returns five members to Parliament, and within the municipal boundaries are included Portobello, Granton, Liberton, Duddingston, and since 1920 also the port of Leith. Pop. 420,281. -- BIBLIOGRAPHY: J. B. Gillies, *Edinburgh, Past and Present*; M. O. Oliphant, *Royal Edinburgh, Her Saints, Kings, Prophets, and Poets*; W. H. O. Smeaton, *Edinburgh and its Story*; H. E. Maxwell, *Edinburgh: a Historical Study*.

**Edinburgh, County of**, or Midlothian, is bounded north by the Firth of Forth, along which it extends 11 or 12 miles; and by the counties of Linlithgow, Haddington, Berwick, Lanark, Peebles, Selkirk, and Roxburgh; area, 234,926 acres, over half of which is arable or under permanent pasture. The south-south-east and south-west parts of the county are diversified with hills, of which the two principal ranges are the Pentlands and Moorfoots, the former stretching across the county to within 4 miles of Edinburgh. The principal rivers are the North and South Eska and the Water of Leith, all running into the Forth. The lowlands towards the Forth are the most fertile; the farms are of considerable size, and the most approved methods of agriculture are in use. The hilly parts are chiefly under pasture and dairy farming. The chief crops are oats, barley, turnips, and potatoes. The manufactures are comparatively limited, but include ale, whisky, gunpowder, paper, and tiles.

The fisheries are valuable. The chief towns are: Edinburgh, Dalkeith, and Musselburgh. Midlothian and Peebles return two members to Parliament. Pop. 506,378.

**Edinburgh, Duke of**, H.R.H. Prince Alfred Ernest Albert, K.G., K.T., K.P., &c., Duke of Saxe-Coburg-Gotha, the second son of Queen Victoria, was born at Windsor Castle, 6th Aug., 1844, died in 1900. At the age of fourteen he joined the navy as naval cadet, and served on various foreign stations. In 1862 he declined the offer of the throne of Greece. On his majority he received £15,000 a year from Parliament, and was created Duke of Edinburgh, Earl of Kent, and Earl of Ulster. In 1867 he was appointed to the command of the frigate *Galatea*, in which he visited Australia, Japan, China, and India. In 1873 he received an additional annuity of £10,000, and next year he married the Grand-Duchess Marie, only daughter of the Emperor of Russia. In 1882 he was made a vice-admiral, and subsequently held important commands. In 1898 he succeeded his uncle as ruler of Saxe-Coburg-Gotha, and resigned £15,000 of his annuity and his other privileges as an English prince, but retained his rank of admiral. He had one son (who predeceased him) and four daughters. He was succeeded as Duke of Saxe-Coburg by his nephew, Leopold Charles, Duke of Albany.

**Edinburgh Review, The**, a quarterly review established in 1802. It had an immediate and striking success, the brilliancy and vigour of its articles being much above the standard of the periodical literature of that time. In politics it was Whig, and did good service to the party. The *Review* was founded by a knot of young men living in Edinburgh, the more prominent of whom were Brougham, Jeffrey, Sydney Smith, and Francis Horner. It was edited from 1803 to 1829 by Jeffrey, under whom it was very successful. In reply to his criticisms Byron wrote his *English Bards and Scotch Reviewers*. Among the famous contributors to the *Review* were Lord Macaulay, Lord John Russell, and John Stuart Mill.

**Edinburgh University**, the latest of the Scottish universities, was founded in 1582 by a charter granted by James VI. The number of professors and other teachers is now over 240. The university is a corporation consisting of a chancellor, rector, principal, professors, registered graduates and alumni, and matriculated students. Its government is administered by the University Court, the Senatus Academicus, and the General Council, as in the other Scottish universities, in all of which new ordinances have been introduced under the Universities (Scotland) Act of 1880. The University Court, which is the supreme governing body of the university,

consists of the rector, who is president, the principal, the Lord Provost of Edinburgh, and eleven assessors. The Senatus superintends the teaching and discipline of the university, and consists of the principal and professors. The General Council consists of the chancellor, who is president, the members of the University Court and Senatus, and the graduates of the university. It takes cognizance of matters generally affecting the well-being of the university. The chancellor is the official head of the university, and it is through him or his deputy, the vice-chancellor, that degrees are conferred. He is elected for life by the General Council. The principal is the resident head of the university and president of the Senatus, and is appointed for life (at Edinburgh by a body called the 'Curators', elsewhere by the Crown). The lord rector is elected for three years by the matriculated students. There are six faculties in the university, viz. arts, science, divinity, law, medicine, and music. Some of the professors are appointed by the Crown, others by special electors, and a considerable number by the curators, who represent the university court and the town council. The number of students in 1919-20 was over 4300. Candidates for degrees in the different faculties must now pass an entrance examination before attendance upon classes. Women are admitted to all courses and degrees, equally with men, except in the faculty of divinity. Those desirous of taking the degree of Master of Arts (M.A.) must attend classes and pass examinations in at least seven subjects, selected from four departments, viz. language and literature, mental philosophy, science, history and law, the course of study extending over three academic years at least. There is a considerable restriction in choice of subjects, since four of them must be (a) Latin or Greek; (b) English or a Modern Language; (c) Logic or Moral Philosophy; (d) Mathematics or Natural Philosophy; and the whole subjects must include both of (a) or both of (c), or two out of the three—mathematics, natural philosophy, and chemistry. Four medical degrees are conferred: Bachelor of Medicine (M.B.), Bachelor of Surgery (Ch.B.), Master of Surgery (Ch.M.), and Doctor of Medicine (M.D.). Before any of these degrees can be obtained the candidate must have been engaged in medical study for at least five years. The degrees in law are Bachelor of the Law (B.L.), Bachelor of Laws (LL.B.), and Doctor of Laws (LL.D.), the last being purely honorary. In divinity the degrees are Bachelor and Doctor of Divinity (B.D. and D.D.), the latter being honorary. In science the degrees are likewise Bachelor and Doctor (B.Sc. and D.Sc.), both conferred in the three departments of pure science, engineering, and public health. There is also a B.Sc. in agriculture. The degree

of Doctor of Philosophy (D.Phil.) is conferred for proficiency in mental science, and that of Doctor of Letters (D.Litt.) for proficiency in literary, philological, and linguistic studies. The degrees of Bachelor and Doctor of Music (Mus.B. and Mus.D.) are also conferred. There is a joint board of examiners for the four Scottish universities, having the control and supervision of the preliminary examinations. The university has splendid laboratories and museums. The foundation stone of a new science laboratory was laid by King George on 6th July, 1920. The library contains 200,000 volumes. There are bursaries, scholarships, and fellowships, amounting annually to about £12,500. Since 1918 the University of Edinburgh unites with the other Scottish universities in returning three members to Parliament. The constituency consists of the General Council. —BIBLIOGRAPHY: J. Kerr, *Scottish Education, School and University, from Early Times to 1908; University Calendar*; Sir Alex. Grant, *The Story of the University of Edinburgh from Early Times to 1908*.

Ed'ison, Thomas Alva, an American inventor, born in Ohio in 1847. He was poorly educated, became a newsboy on the Grand Trunk Railway, and afterwards, having obtained some type, issued a small sheet of his own known as the *Grand Trunk Herald*, printing it in a freight car. He then set himself to learn telegraph work, and in a short time became an expert operator. In 1868, while at Indianapolis, he invented an automatic telegraph repeater. This was the first of a long series of improvements and inventions. He opened an extensive establishment at Newark for the manufacture of electrical, printing, automatic, and other apparatus. In 1876, his health breaking down, he gave up manufacturing and devoted himself to investigation and invention. Amongst his numerous inventions are the quadruplex and sextuplex telegraph, the carbon telephone transmitter, the 'Edison system' of lighting, the electric fire-alarm, the 'Edison electric railway', the phonograph, and the megaphone. His improvements in the cinematograph made it practicable, though he did not originate the idea of it.

Ed'monton, an urban district and parliamentary borough in England, county of Middlesex,  $7\frac{1}{2}$  miles north of London, with an extensive trade in timber, carried on by the Lea River navigation. The 'Bell at Edmonton' has become famous by association with the adventures of Cowper's *John Gilpin*. The borough returns one member to Parliament. Pop. 64,820.

Edmonton, a town of North-Western Canada, on the North Saskatchewan (here navigable). Since 1905 it is the capital of the province of Alberta, and has grown considerably in recent years. It is an important terminal for the Canadian Pacific and Canadian National Railways,

and is the distributing centre of an immense area, including the Peace River district. Cattle are raised in the vicinity. Easily-mined coal is worked here. Pop. 61,000.

**Ed'mund, St.**, King of the East Angles, began to reign in 855, died in 870. He was revered by his subjects for his justice and piety. In 870 his kingdom was invaded, and he himself slain, by the Danes. The Church made him a martyr, and a town (Bury St. Edmunds) grew up round the place where he was buried.

**Edmund I**, King of England, an able and spirited prince, succeeded his brother Athelstan in 940. He conquered Cumbria, which he bestowed on Malcolm, King of Scotland, on condition of doing homage for it to himself. He was slain at a banquet 26th May, 940.

**Edmund II**, surnamed *Ironsides*, King of England, the eldest son of Ethelred II, was born in 989. He was chosen king in 1016, Canute having been already elected king by another party. He won several victories over Canute, but was defeated at Assandun in Essex, and forced to surrender the midland and northern counties to Canute. He died after a reign of only seven months.

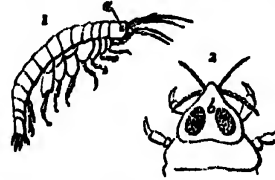
**Edom**, in the New Testament *Idumæa*, in ancient times a country lying to the south of Palestine. The Edomites are said in *Genesis* to be the descendants of Esau, who was also called Edom (a word signifying 'red'), and who dwelt in Mount Seir, the mountain range now called *Jebel Shera*, stretching between the Dead Sea and the Gulf of Akabah. Edom is frequently mentioned in the Assyrian inscriptions. The Edomites were subdued by King David, and after the separation of the ten tribes remained subject to the Kingdom of Judah until the reign of Jehoram, when they revolted and secured their independence for a time. They were again subdued about half a century later by Amaziah, and again, in the reign of Ahaz, recovered their independence, which they maintained till the time of the invasion of Judea by Nebuchadnezzar. They fell under the rule of the Persians, and afterwards their fortunes were merged in those of Arabia. The chief city in this region was Petra, which now presents remarkable ruins, as well as several rock-cut temples.

**Edred**, King of England, son of Edward the Elder, succeeded to the throne on the murder of his brother, Edmund I, in May, 946. He quelled a rebellion of the Northumbrian Danes, and died in 955.

**Edriophthalmata**, one of the great divisions of the Crustacea, including all those genera which have their eyes sessile, or embedded in the head, and not fixed on a peduncle or stalk as in the crabs, lobsters, &c. It is divided into two orders. (1) Amphipoda, laterally flattened, as in the

marine sandhopper (*Talitrus*), and the fresh-water shrimp (*Gammarus*). (2) Isopoda, flattened from above downwards. Sea-slaters or wood-lice (*Ligia* and *Idothea*); fish parasites (*Cymothoa*); fresh-water wood-lice (*Asellus*); land wood-lice (*Oniscus*, *Porcellio*, *Armadillidium*, which can roll up).

**Edri'si**, Abu-Abdallah Mohammed, a famous Arabian geographer, a descendant of the ancient princely family of the Edrisites, born about A.D. 1100, died about 1180. He studied at the Moorish university of Cordova, after which he travelled through various countries. At the request of King Roger II of Sicily he constructed a globe with a map of the earth, which represented all the geographical knowledge of the age. He accompanied this with a descriptive treatise completed about 1154, and still extant. The



Edriophthalmata

- 1, Fresh-water shrimp (*Gammarus pulex*). a, Single eye.  
2, Head of *Cymothoa*. b, Clusters of simple eyes.

work was published at Rome in Arabic (1502), and in 1619 a Latin translation of it, under the title of *Geographia Nubiensis*, appeared in Paris.

**Education** is the name applied to the systematic instruction given by each succeeding generation to the young of the race to fit them for the work of life. The word itself is derived from the Latin verb *educare*, which means to rear, to nourish, to bring up, and also to educate. Long before the dawn of civilization men saw that the young had to be prepared for the battle of life; had to learn how to make and how to use the offensive and defensive weapons employed against their enemies; how to form or build shelters to protect themselves against the weather and against their foes; how to make traps or snares for the wild things on which they fed; how, in fact, to use their powers of mind and body in such a way as to secure for themselves the fullest and most satisfactory life possible under the circumstances in which they found themselves.

While education thus understood would be the story of man on the earth, an account of his more or less satisfactory, but always continuous, efforts to perfect the relations between his desires and his environment, it would have to embrace also an account of the conflict between the demands of communities and the rights of individuals. Education, however, as we under-

stand it, is more limited in its scope. It is the instrument employed by the State for the training of its citizens.

The Greeks were the first Europeans to treat education as a science. The results they obtained were good, and have to a certain extent determined the course taken by European education ever since. Plato defined the aim of the education of which he gives us an account in the *Republic*, to be the "development in the body and in the soul of all the perfection which it is possible for them to attain". This was the Greek ideal of what education should aim at; a high ideal indeed; but one that omits an element of immense importance which we find introduced in Milton's definition of the 'end of learning', that is, the aim of education. Milton boldly declares this to be: "To repair the ruin of our first parents by regaining to know God aright, and out of that knowledge to love Him, as we may the nearest by possessing our souls of true virtue, which being united to the heavenly grace of faith makes up the highest perfection". Perfection is the end sought in both cases, and which seems the nobler it is unnecessary to say. This impression is deepened when he proceeds to declare that as "Our understanding cannot . . . arrive so clearly to the knowledge of God and things invisible, as by orderly conning over the visible and inferior creatures, the same method is necessarily to be followed in all discreet teaching".

By Aristotle the order of education was: first, education of the body, the just and proportionate development of its powers. The instrument employed for this purpose was gymnastics; not the gymnastics employed in training professional athletes, but more moderate exercises; for, as the philosopher insists, too strenuous bodily exertion is apt to spoil the child, because body and mind must not be hard worked at the same time. Music, according to him, had various aims: education proper, the training of the affections, and the occupation of leisure. Drawing was taught as a branch of music for the purpose of developing the child's sense of beauty, mathematics were taught to cultivate his intellect, and dialectic (logic and philosophy) to prepare the pupil for a scientific training.

To the idealistic philosopher Plato, the whole life of man, at least the whole of what we may call the active life, was educative. Education was State-controlled, and at the end of the first six years, spent by the child in the seclusion of family life, the State took charge. The aim of the education proposed by Plato was to develop in the child the cardinal virtues—honour to parents, love of fellow-citizens, courage, truthfulness, and self-control. From the seventh to the tenth year the training was mainly in gym-

nastics; from the tenth to the thirteenth the child learned to read and to write; from the thirteenth to the sixteenth his affections and his sense of the beautiful were cultivated through learning poetry and studying music; from the seventeenth to the twentieth year he applied himself mainly to athletics, so that he might be qualified to take his share in the defence of the State. At twenty men were called upon to choose their occupation; to turn their minds to the study of the sciences; and to shape by practical military and other services to the State that character which it was the aim of education to form. From thirty to thirty-five Plato supposes the citizens of his ideal republic to devote themselves to the study of *Dialectics*, the method of purely intellectual knowledge, by which reason, using hypothesis, arrives at the first principles of things. From thirty-five to fifty the life of the citizen was to be given up to public service, that is, to the promotion in the position for which he was best fitted of the general well-being.

The training set forth by the Greek philosophers was the training thought necessary to fit a man to be a ruler. As the Greek city states were slave states, and most of the manual work was performed by slaves, that necessary part of the training of the youth of the community is ignored. This fact has had, undoubtedly, an enormous influence on the ideas of education put forward since. The preliminary training demanded by the Greeks included, besides gymnastics, grammar and music. At a later time these were understood to include the seven arts: Grammar, Rhetoric, Dialectic (*Trivium*), and Arithmetic, Music, Geometry, and Astronomy (*Quadrivium*). To the Greeks, myths were the instruments of the earliest education, the aim of which was the development of a character in the citizen which would lead him to give his best and most loyal services to the State.

The aim of Greek education was the formation of the philosophic thinker, the man fitted by nature and training to guide and direct the energies of the man of action. Roman education, on the other hand, directed its efforts mainly to the moulding of the man of action himself. The Romans adopted the form rather than the spirit of Greek education. The aim of Roman education was to make a man who could do things; a practical man, a man full of energy, who was ever ready to sacrifice himself in the interests of the State; a man who knew the laws and who regulated his conduct by them; who revered his father and his country's gods; and found his chief pleasure in the complete overthrow and utter destruction of his country's foes. He could discourse eloquently and not unphilosophically; and he spared neither himself

nor others in his effort to maintain the freedom of his country, and to bring destruction on the enemies of Rome. Roman education began in the home, and during the earlier years was largely directed by the mother. Later the preparation of the boy for life was taken over by the father; but it is probable that from very early times many, if not most, Romans boys were sent to school, where, under the *magister literarius* (elementary teacher), the *grammaticus* (advanced teacher), and the *rhetor* (professor), they acquired the knowledge and accomplishments it was needful for them to obtain.

The Roman schools, elementary and secondary, seem to have been conducted in a verandah, and boys and girls seem to have been taught in the same school. The chief Roman writers on education are Cicero, Seneca, and Quintilian. Quintilian tells us that Cato also wrote a treatise on the subject, but that that work had been lost. The oratorical training of which Quintilian was the expositor seems to have been largely out of connection with real life; and, though he claims that the orator must be a widely cultured, wise, and honourable man, seems to have developed a tendency to the bombastic abuse of ornate and stilted speech. The practical effects, too, of the corruption of family education were far from satisfactory. Moral degradation followed, and humanity seems to have been rescued only by the introduction of a new ideal of life, which substituted for the pagan self-reliance, self-control, moderation, and proportion, self-denial, self-forgetfulness, and humility; which made the last, indeed, the chief virtue, and looked on pride and self-confidence as spiritual sins.

The introduction of Christianity was followed by the inroads into the Roman Empire of barbarous tribes from the north and east. Before these attacks the Western Roman Empire collapsed, and with it to a greater or less extent the educational system of the time.

It must be remembered that between three and four hundred years elapsed between the downfall of the Western Roman Empire and the beginnings of the Holy Roman Empire under Charlemagne. Classical or pagan culture, as profane learning, was at a discount, and the aim of the monasticism which grew out of the introduction of Christianity was mystic absorption in the contemplation of God.

This interval was followed by the efforts of Charlemagne to revive Roman culture, and to establish schools throughout Western Europe. In this he was aided by Alcuin and other scholars from England, where in the comparative quiet that followed the conquest of Britain there had grown up a system of education. Throughout his dominions three classes of schools were established by Charlemagne, the Palace School, the

Bishop's School, and the Monastery School. These were intended to take the place of the splendid system of public schools that had grown up under the Roman Empire. The course of studies established in these mediæval schools, following the practice of Greece and Rome, was divided into two parts: the *Trivium*, including Grammar, Dialectic, Rhetoric; and the *Quadrivium*, which embraced Geometry, Arithmetic, Music, and Astronomy. Education in the palace or castle schools had a different aim. It sought to develop the bodily powers, and to awake in the pupils that respect for the weak which was shown in the worship of women, and that love of justice, and belief in its supremacy, which characterized the *chivalry* of the Middle Ages.

The scholastic education of this time laid special stress on formal logic and metaphysics. Latin was taught, was, indeed, the universal language of the period. Questions about the nature of the unseen and the spiritual occupied much of men's minds; while their time was taken up in discussing the character of universals, the true realities which lay behind the individual manifestations of experience. As a rule, the physical world was ignored, and human intelligence disregarded; but there were notable exceptions, among which the teachings of Bishop Grosseteste (died 1253) and of Roger Bacon (1214 to 1294) take a prominent place.

It was during the period of scholasticism that universities, in imitation of the trade guilds of the time, sprung up in different parts of Europe, particularly in Spain, Italy, France, and England. To the famous schools both in England and on the Continent scholars flocked from all parts, and their instruction presented little difficulty, as Latin, the language in which the instruction was given, was the common language of scholars in Western Europe. The establishment of universities in different countries was a sign rather than a cause or result of that intellectual and spiritual awakening which, after nearly a thousand years of almost complete stagnation, manifested itself among the peoples of Europe.

It is usual to date the Renaissance from 1453, the fall of Constantinople; but it must not be forgotten that owing to the clash between East and West, the struggle between Christianity and Mohammedanism (the Crusades, as these religious wars were called), there had from the end of the eleventh century been a considerable change of outlook among the nations of Western Europe. This was specially the case in Italy, where city states, not unlike those of Greece in their character, had sprung up, and where, as in Greece in the time of Pericles, there had been the great outburst of literary activity which is associated with the names of Boccaccio, Dante, and Pet-



rare. In Northern and Western Europe the intelligence stimulated by the new learning was directed towards the improvement of the method of study. All study was linguistic. Latin was the instrument of common intercourse; Greek and Hebrew were sacred as the tongues in which the Scriptures had been conveyed; it was no wonder, therefore, that the humanistic education was almost entirely confined to the study of languages. Sturm (1507 to 1580) drew up a scheme of studies which had long a great influence on the school courses of instruction throughout Europe.

The reaction against authority which marked the Reformation period was specially noted for the reaction against the purely verbal education given to the young, whose education, as we learn from Locke, was calculated to teach them "not to believe, but to dispute", and to fit them "for the university, not for the world". On the Continent Rabelais (1483 to 1538) led this realistic movement, which was continued by Montaigne (1533 to 1592) in France, and under the influence of Bacon by Brinsley and Hoole in England, and Ratke and Comenius on the Continent. Up to this time the chief English writers on the subject of education had been Sir Thomas Elyot in his *Governour*, Roger Ascham in his *Scholemaster*, and Richard Mulcaster in his *Positions*.

The intellectual activity which marked in England the closing decades of the sixteenth and the first part of the seventeenth century saw the issue of Milton's *Tractate*, one of the most famous books on education ever produced. The *Tractate* discusses only the kind of education that should be given to gentlemen's sons between the ages of twelve and twenty-one, so that it is strictly limited in its application, as it does not deal with the education of the people, nor with the education of women. The ideal which Milton put before him as the aim of "a complete and generous education" was "to fit a man to perform justly, skilfully, and magnanimously all the offices both private and public of peace and war". Milton in his *Tractate* discusses studies, exercise, and diet, showing that he clearly understood that education was concerned with the body as well as the mind and spirit.

Towards the close of the seventeenth century Locke, an English physician and philosopher, published (1693) his *Thoughts concerning Education*, a book which influenced immensely the character and direction of future educational studies. As he informs his readers in his letter to Edward Clarke, he counsels everyone "after having well examined and distinguished what fancy, custom, or reason advises in the case . . . to promote everywhere that way of training up youth . . . which is the easiest, shortest, and

likeliest to produce virtuous, useful, and able men in their distinct callings". He begins his essay with the statement, "A sound mind in a sound body is a short but full description of a happy state in this world", and the suggestions he makes as to the physical, moral, and intellectual training of the young are for the most part sound. He decried a too severe discipline, maintaining that "If the mind be curbed and humbled too much in children, . . . they lose all their vigour and industry". On the other hand, he held that if you "Remove hope and fear, there is an end of all discipline"; and he held that, as far as possible, "Childish actions are to be left perfectly free and unrestrained". He applied the science of psychology to the study of child nature, and of the methods to be employed in training it; and so prepared the way for the modern methods of education. "Interest is the secret of Herbart", according to one of his devoted admirers. Locke seems to have anticipated this when he declares that "None of the things they are to learn should ever be made a burden to them, or imposed on them as a task".

Though his attitude towards the universe was utterly opposed to the attitude of Locke, Rousseau drew almost all that was practical in his scheme for the education of the young from the English writer. Rousseau's work, though largely inspired by Locke, was essentially of a revolutionary kind. It held that man is the great corrupter; that "Everything is good as it comes from the hands of the Creator; and that man's handling makes everything worse". In effect he said, leave the child as much as possible alone. An attempt constantly to direct him can only result in stupefying him. It is true we receive our education from nature, from men, and from things; but nature must be our guide in determining the use of the other two. As few restraints as possible must be imposed on the child, and the use of books should be prohibited. For the child there should be "no other book but the world", and "no other instruction but facts". The child's education he divides into four stages, infancy, childhood, boyhood, and youth. The first two stages last till the beginning of the thirteenth year, when the boy is supposed to be fit for instruction. From such instruction the teaching of words must disappear, and the teaching of things must take its place. The subjects most suitable for instruction were, Rousseau declared, measuring, drawing, geometry, speaking, and singing. Books, he declares, are useless, are, indeed, altogether harmful. The method he advocates is the method of self-teaching and the use of the senses, which Rousseau held would work to the profit of the intelligence. The child's knowledge should rest



on his own observation, and not on belief in authority, and each child should be taught a manual trade.

At fifteen, according to Rousseau, real education begins; and it is the duty of the teacher to study the subject he has to act upon, in other words, to discover the nature of the pupil, which must in all cases determine the means and the method employed in his education. Two things must be taught. These are the true relations, racial and individual, that exist among men; and how to direct and control the emotions aroused by the environment so that the best results may arise. Here he finds occasion for the use of moral teaching and for instruction in religion. The facts of history must be placed before him; but he must be left to form his own judgment. He is now to be taught religion as a help to the regulation of the passions; but not the religion of any particular sect. His time is to be given up largely to reading and to the acquirement of taste; to the study of history and eloquence; and to attendance at the theatre.

The revolutionary doctrines preached by Rousseau in his *Émile* and in his other educational works had an immense effect on the Continent, and particularly on the work of one of his most ardent admirers, the Swiss farmer and schoolmaster Pestalozzi, an eccentric, dubbed by his schoolfellows "Harry Oddity of Kools-town". Thinking the education demanded for *Émile* by Rousseau vastly superior to that which he himself received, he very early became an ardent admirer of the system advocated by the French philosopher, and an eager reformer. *Émile* and the *Contrat Social* were condemned by the magistrates of Zurich, and Pestalozzi and some of his fellow-students were imprisoned for the *Memorial* in which they defended these works. Later Pestalozzi determined to be a farmer. He was married at the age of twenty-three, and started growing madder and vegetables on some poor land near Zurich. On the land he built for himself a house, the *Neuhof*.

In the winter of 1774 he hit upon the expedient of taking into his house some twenty poor children of the neighbourhood, whom he treated as his own. They worked with him in summer in the fields, and in winter in the house. Improved health for the children, increased intelligence, and a manifest devotion to their benefactor were some of the results speedily displayed, and the experiment drew much attention to itself. Urged on by his love for the children, Pestalozzi took in a larger number, and in a very short time found himself bankrupt. In this period of seeming disaster Pestalozzi turned author. The books which he produced were greedily read off the Continent, and aroused the greatest interest. After some work at

Stanz and at Burgdorf, Pestalozzi settled to work in the castle of Yverdon on Lake Neuchâtel, which became in the early years of the nineteenth century a place of pilgrimage for European students and lovers of education. Forced to leave Yverdon in 1815, he continued his work at Clindy till 1824.

Friedrich Froebel spent the years 1807 to 1809 at Yverdon, and so fitted himself to carry on the work Pestalozzi had to some extent made popular. His name, however, is specially associated with the schools for very young children to which he gave the name of *Kindergarten*, that is, 'gardens of children', places where young children, like young plants, were properly watched and tended. For the children in these schools their employment was to be play, play from which and by which they acquired clear notions regarding themselves and their environment. "Education", he asserted, "should lead and guide man to clearness concerning himself and in himself, to peace with nature, and to unity with God." He held that powers were developed by exercise; that failure to use any part of the body or mind led to the shrinkage of the part, and sometimes even to its complete loss. He held that if we wish to develop the body we must exercise the body, and that, similarly, if we wish to develop the intellect or the emotions they must be exercised. He insists that teachers must be careful to interfere as little as possible; must remember at all times that the aim of teaching is "to bring ever more and more out of man rather than to put more and more into him". He based his system on action; agreed with Montaigne that "children's games were their most serious occupations"; and with Locke that "All the plays and diversions of children should be directed towards good and useful habits". Froebel was not the founder of infant schools. These were first established on the Continent and in Britain with the object of helping mothers. In Britain their establishment is associated with the names of the educational enthusiasts James Buchanan and Samuel Wilderspin.

Nearly ten years before Froebel's stay with Pestalozzi at Yverdon, Herbart, next to Kant and Hegel the most influential of German philosophers, visited the inspired educationist at Burgdorf, and found him employing methods based on the principles which he himself had worked out in his psychology. To both it was clear that there is a definite order in which subjects should be taught to the children, and that this order is determined, not merely by the relation of the subjects to each other, but by their power of satisfying the growing wants and capacities of the child. Pestalozzi had arrived intuitively at a method, and had practically applied it, which Herbart had scientifically

worked out as applicable to the whole educational field. Three years later Herbart published pamphlets on Pestalozzi's best-known book, *How Gertrude teaches her Children*, and on *The A.B.C. of Sense-perception*, and in these showed what weight he attached to observation as an instrument of education. Two years later he published one of his most notable works on education, *The Aesthetic Revelation of the World*, and in 1806 *General Pedagogy*. In 1809 he was appointed professor of philosophy at Königsberg, where he remained till 1833, and where his services to the cause of education, both by his writings and by his establishment of normal schools and experimental schools, cannot be exaggerated. He warns teachers not to educate too much; to be careful not to destroy the individuality of the child, such individuality being that which characterizes individuals of the same class. He lays the greatest stress on the importance to the teacher of child study, maintaining that he will be unable to teach unless he knows the child as he is. For Herbart the aim of education is summed up in morality, "the highest aim of humanity and consequently of education", itself. "I have no conception", he writes, "of education without instruction, just as I do not acknowledge any instruction that does not educate." "Instruction", he says elsewhere, "will form the circle of thought, and education the character; the last is nothing without the first." A great deal, according to Herbart, depends upon the pupil himself, who "grasps rightly what is natural to him", and who must be saved from the tendency to one-sidedness in which following his bent would result, by the cultivation in him of many-sidedness. This cultivation involves the control of the pupil's mental activity, and the instrument for this control is interest, which causes the pupil's complete absorption in its object. For the attainment of this Herbart proposes certain formal steps of instruction. These steps are usually set forth as (1) Preparation, (2) Presentation, (3) Comparison, (4) Generalization, (5) Application.

The nineteenth century was a period of continuously increasing interest in education, and of a generally growing belief in its utility. It was taken up by the Governments of the different countries, and ordered and regulated almost out of existence. Seven years before the death of Pestalozzi the first public grant for education was made by the British Parliament, and from that time up to the present the Government has continued to extend its power over the education of the country. For a long time the Government in Britain was satisfied to subsidize elementary education; but later it insisted on hard-and-fast lines of instruction. So thoroughly were these regulated in most countries that a French

Minister of Education could boast he was able to say what work every child in France was engaged in at that particular moment.

In Britain it was only bit by bit, and with very considerable reluctance, that the Government took upon itself the responsibility for the education of the country. In Scotland a national system of general education, constituted in 1560, remained in force until reconstructed by the *Education Act of 1872*. (See *Scotland*.) Compulsory education was introduced into England in 1870, together with what was described as payment by results; and, for some time, the aim which the teacher had to keep before him was the production at the annual examination of the largest number of pupils who could satisfy the tests in Reading, Writing, and Arithmetic, or, as they were called, the 'three R's', and so earn the Government grant. For between thirty and forty years this unnatural and mechanical system remained in force. From 1804 onwards Commissioners after Commissioners sought to reduce English secondary education to order. The most notable of these was The Bryce Commission of Enquiry into Secondary Education, 1804-5, whose recommendations have since been put into force by legislation. One of the results of the increasing interest in education throughout England was the founding, early in the latter half of last century, of great day schools, like the City of London, St. Paul's, and Merchant Taylors, in London and other large cities; and, after the passing of the Education Act of 1902, the establishment everywhere of Council Secondary Schools.

Of the immense number of works on education issued during the last half of the nineteenth century, perhaps the best known are those of Herbert Spencer and of Professor Bain. The former seeks to explain education from the Darwinian standpoint, and the latter to determine from psychology the intellectual value of the various subjects taught in school, and the average age at which they should be taught to children. Of practical English educators during the nineteenth century, the most outstanding names are undoubtedly those of Arnold of Rugby, Thring of Uppingham, and Abbott of the City of London School.

In recent times the advances made in the theoretical and practical studies of the sciences of anthropology, physiology, and psychology have exercised an enormous influence on educational theories and practices. Careful observations of young children by scientific observers like Darwin, Darwin, and Preyer have added greatly to our knowledge of child-nature; and helped to suggest new methods of studying it and developing it. The result has been the promulgation within the present century of a number of educational methods, some of which, in con-

trast to the older practices, must seem almost revolutionary. Among these must be remembered the 'Heuristic Method' of teaching science put forward by Professor H. E. Armstrong. The object of the method is to put the student as completely as may be in the position of an original investigator; and it has been classed by writers on education as being, like so many other modern methods, a 'play method'. Froebel in his kindergarten was one of the first to introduce successfully the play method in education, and the 'gifts' by which the plan was carried through were of his own devising; but such can not be said of Dr. Montessori, whose method of education attracts so much attention at the present time. The Montessori apparatus was originally devised by Dr. Seguin for the instruction of mental defectives. Dr. Montessori used the apparatus first for the training of young children, but the cardinal feature of the Montessori system is the determined effort to make the child responsible for his own education, and to place as little as possible with his teacher. The apparatus is so contrived that it can only be used in one way if the problem is to be solved; so the child is forced to attend to differences in size and shape and carefully to manipulate the different pieces. In addition the Montessori system attempts to cultivate social virtues; teaches the children to live and work and play with others, and so to learn to be well-adjusted. The teacher in this system retires into the background, and the children are left to go their own way, to choose their own tasks, and to be their own critics. Great attention is also given to the physical development of the children.

Experimental education has been attempted both in Germany, where the need for it was first put forward by Kant, and in England; but it is in the United States of America that the chief advances in this direction have been made. Here the Binet attempt to measure the intelligence of the child, to fix in fact a metric scale of intelligence, has been elaborated, and the Binet-Simon system of tests devised, and later modified by L. M. Terman. There, too, schools have been established which have tried the working out of what may be described as the 'non-interference with the pupil principle'. Among these may be mentioned the 'George Junior Republic' and the Gary Schools. The latter, we are told by their founder, were "not instituted to turn out good workers for the steel company, but for the educational value of the work they involved". To this must be added the 'Dalton Laboratory Plan', tried lately as an experiment by Miss Helen Parkhurst in a public secondary day school in Dalton. By this plan, the time-table is abolished, the child under-

takes to get up a certain amount of work each month in each particular subject, and is left free to distribute his time as he chooses, so that he can devote more time to those subjects in which he is backward. The school is divided into departments (laboratories) each under a specialist who gives the help needed, but leaves the pupil to himself as much as possible.—BIBLIOGRAPHY: Bartley, *The Schools for the People*; Norwood and Hope, *Higher Education of Boys in England*; Quick, *Essays on Educational Reformers*; Brownling, *An Introduction to the History of Education Theories*; Sleight, *Educational Values and Methods*; Nunn, *Education: Its Data and First Principles*; Wilton, *What does mean by Education?* *The New Teaching*, edited by Adams; Kerr, *Scottish Education*; Morrison, *Education Authorities' Handbook*; Dewey, *Schools of To-morrow*; Rusk, *Introduction to Experimental Education*; Montessori, *The Montessori Method and The Advanced Montessori Method*.

Education Act, the name given to several Acts dealing with education in Great Britain. Among the principal Education Acts are: (1) that of 1870, which introduced compulsory education; (2) that of 1891, which reduced, or in some cases abolished, school fees; (3) that of 1902, which authorized the levying of an education rate; and (4) that of 1918, which raised the age for leaving school, and made education compulsory up to the age of eighteen by means of continuation schools. Pupils must attend these schools for 320 hours each year.

Edward, known as *the Elder*, King of England, son of Alfred the Great, born about 870, died in 925. He succeeded his father in 901, and his reign was distinguished by successes over the Danes. He fortified many inland towns, acquired dominion over Northumbria and East Anglia, and subdued several of the Welsh tribes.

Edward, surnamed *the Martyr*, King of England, succeeded his father, Edgar, at the age of fifteen, in 975. His reign of four years was chiefly distinguished by ecclesiastical disputes. He was treacherously slain in 979 by a servant of his stepmother, at her residence, Corfe Castle. The pity caused by his innocence and misfortune induced the people to regard him as a martyr.

Edward, King of England, surnamed *the Confessor*, was the son of Ethelred II, and was born at Islip, in Oxfordshire, about 1004. On the death of his maternal brother, Hardekanute the Dane, in 1041, he was called to the throne, and thus renewed the Saxon line. Edward was a weak and superstitious, but well-intentioned prince, who acquired the love of his subjects by his monkish sanctity and care in the administration of justice. His queen was the daughter of Godwin, Earl of Kent. He died in 1066, and was succeeded by Harold, the son of Godwin.

Edward caused a body of laws to be compiled from those of Ethelbert, Ina, and Alfred, to which the nation was long fondly attached. He was canonized by Pope Alexander III in 1161.

Edward, Prince of Wales, surnamed the *Black Prince*, born 15th June, 1330, the eldest son of Edward III and Philippa of Hainault. In 1346 he commanded part of the forces at the battle of Crécy, and earned the praise of his warlike father. It was on this occasion that he adopted the motto *Ich dien* (I serve), used by all succeeding Princes of Wales. In 1355 he commanded the army which invaded France from Gascony, and distinguished himself the following year at the great battle of Poitiers. By the Peace of Brétigny the provinces of Poitou, Saintonge, Périgord, and Limousin were annexed to Guienne and formed into a sovereignty for the prince under the title of the Principality of Aquitaine. A campaign in Castile, on behalf of Pedro the Cruel, and the heavy taxes laid on Aquitaine to meet the expenses, caused a rebellion, and ultimately involved him in a war with the French king. His own health did not allow him to take the field, and having seen his generals defeated he withdrew into England, and after lingering some time died (1370), leaving an only son, afterwards Richard II.

Edward I (of the Norman line), King of England, son of Henry III, was born at Winchester in 1239, died 7th July, 1307. The contests between his father and the barons called him early into active life, and he finally quelled all resistance to the royal authority by the decisive defeat of Leicester at the battle of Evesham, in 1265. He then proceeded to Palestine, where he showed signal proofs of valour, although no conquest of any importance was achieved. His father's death in 1272 gave him the crown. On his return home he showed great vigour as well as a degree of severity in his administration. He commenced a war with Llewellyn, Prince of Wales, which ended in the annexation of that Principality to the English Crown in 1283. Edward's ambition was to gain possession of Scotland, but the death of Margaret, the Maid of Norway, who was to have been married to Edward's son, for a time frustrated the king's designs. But on 26th Dec., 1292, John Baliol was induced to do homage for his crown to Edward at Newcastle. Baliol was forced by the indignation of the Scottish people into war with England. Edward entered Scotland in 1296, devastated it with fire and sword, and placed the administration of the country in the hands of officers of his own. Next summer a new rising took place under William Wallace. Wallace's successes recalled Edward to Scotland with an army of 100,000 men. Wallace was at length betrayed into his hands and executed as

a traitor. All Edward's efforts, however, to reduce the country to obedience were unavailing, and with the flight of Robert Bruce, Earl of Carrick, to Scotland, the banner of Scottish independence was again unfurled. Edward assembled another army and marched against Bruce, but only lived to reach Burgh-on-Sands, a village near Carlisle, where he died. Edward I was wise in council and vigorous in action. During his reign great progress was made in the establishment of law and order throughout the land.

Edward II, King of England, born at Carnarvon Castle in 1284, and the first English Prince of Wales, succeeded his father, Edward I, in 1307. He was of an agreeable figure and mild disposition, but indolent and fond of pleasure. After marching as far as Cumnock, in Ayrshire, with the army collected by his father, he returned, dismissed his troops, and abandoned himself entirely to amusements. His weakness for a clever but dissolute young Gascon, Piers Gaveston, on whom he heaped honours without limit, roused the nobles to rebellion. Gaveston was captured in Scarborough Castle, and executed as a public enemy on 19th June, 1312. Two years after this, Edward assembled an immense army to check the progress of Robert Bruce, but was completely defeated at Bannockburn. In 1322 he made another expedition against Scotland, but without achieving anything important. The king's fondness for another favourite, Hugh le Despenser, had made a number of malcontents, and Queen Isabella, making a visit to France, entered into a correspondence with the exiles there, and formed an association of all hostile to the king. Aided by a force from the Count of Hainault, she landed in Suffolk in 1326. Her army was completely successful. The Despensers, father and son, were captured and executed, and the king was taken prisoner and confined in Kenilworth, and ultimately in Berkeley Castle, where he was murdered 21st Sept., 1327.

Edward III, King of England, son of Edward II by Isabella of France, was born in 1312, died 21st June, 1377. On his father's deposition in 1327 he was proclaimed king under a council of regency, while his mother's lover, Mortimer, really possessed the principal power in the State. The pride and oppression of Mortimer led to a general confederacy against him, and to his seizure and execution (10th Oct., 1330). Edward now turned his attention to Scotland, and, having levied a well-appointed army, defeated the regent, Douglas, at Halidon Hill, in July, 1333. This victory produced the restoration of Edward Baliol, who was, however, again expelled, and again restored, until the ambition of the English king was diverted by the prospect of succeeding to the throne of France. Collecting an army and accompanied by the Black Prince, he crossed

over to France. The memorable battle of Crécy followed, 25th Aug., 1346, which was succeeded by the siege of Calais. In the meantime David II, having recovered the throne of Scotland, invaded England with a large army, but was defeated and taken prisoner by a much inferior force under Lord Percy. In 1348 a truce was concluded with France; but on the death of King Philip, in 1350, Edward again invaded France, plundering and devastating. Recalled home by a Scottish inroad, he retaliated by carrying fire and sword from Berwick to Edinburgh. In the meantime the Black Prince had penetrated from Guienne to the heart of France, fought the famous battle of Poitiers, and taken King John prisoner. A truce was then made, at the expiration of which (1359) Edward again crossed over to France and laid waste the provinces of Picardy and Champagne, but at length consented to a peace. This confirmed him in the possession of several provinces and districts of France which were entrusted to the Prince of Wales (the Black Prince), but gradually all the English possessions in France, with the exception of Bordeaux, Bayonne, and Calais, were lost.

Edward IV, King of England, was born in 1442, died in April, 1483. His father, Richard, Duke of York, was grandson of Edmund, Earl of Cambridge and Duke of York, fourth son of Edward III, while the rival line of Lancaster descended from John of Gaunt, the third son. The York line had intermarried with the female descendants of Lionel, the second son, which gave it the preferable right to the Crown. Edward, on the defeat and death of his father at the battle of Wakefield, assumed his title, and, having entered London after his splendid victory over the troops of Henry VI and Queen Margaret at Mortimer's Cross, in Feb. 1461, was declared king by acclamation. The victory of Towton, soon after his accession, confirmed his title, and three years after this, on 4th May, 1464, the battle of Hexham completely overthrew the party of Henry VI. The king now made an imprudent marriage with Elizabeth, widow of Sir John Grey, at the very time when he had dispatched the Earl of Warwick to negotiate a marriage for him with the sister of the French king. He thus alienated powerful friends, and Warwick, passing over to the Lancastrian cause, gathered a large army, and compelled Edward to fly (in Sept. 1470). Henry's title was once more recognized by Parliament. But in 1471 Edward, at the head of a small force given him by the Duke of Burgundy, landed at Ravenspur in Yorkshire, and his army, being quickly increased by partisans, marched swiftly on London and took the unfortunate Henry prisoner. Warwick now advanced with an army to Barnet, where a battle was fought, 4th April, 1471, which ended in the death of

Warwick and a decisive victory for Edward. Shortly afterwards Edward also met and defeated a Lancastrian army, headed by Queen Margaret and her son Edward, at Tewkesbury. The prince was murdered, and the queen was thrown into the Tower, where Henry VI soon after died. Edward was preparing for an expedition against France when he died.

Edward V, King of England, the eldest son of Edward IV, was in his thirteenth year when he succeeded his father in 1483. His uncle, the Duke of Gloucester, soon made himself king as Richard III, and caused the young king and his brother to be sent to the Tower, where he had them smothered by ruffians.

Edward VI, King of England, son of Henry VIII by Jane Seymour, was born in 1537, died in July, 1553. At his father's death he was only nine years of age. His education was entrusted to men of the first character for learning, under whose training he made great progress, and grew up with a rooted zeal for the doctrines of the Reformation. His reign was, on the whole, tumultuous and unsettled. In Oct., 1551, the Protector Somerset, who had hitherto governed the kingdom with energy and ability, was deposed by the intrigues of Dudley, Duke of Northumberland, who became all-powerful. He induced the dying Edward to set aside the succession of his sisters, Mary and Elizabeth, and settle the crown upon Lady Jane Grey, to whom he had married his son Lord Guildford Dudley. Edward VI restored many of the grammar schools suppressed by Henry VIII, and these schools are still known as King Edward's schools.

Edward VII, King of Great Britain and Ireland and Emperor of India, eldest son of Queen Victoria and the Prince Consort, was born at Buckingham Palace on 9th Nov., 1841, died 6th May, 1910. In Dec., 1841, he was created Prince of Wales. He was educated under private tutors and at Edinburgh, Oxford, and Cambridge; visited Canada and the United States in 1860; and underwent military training at the Curragh camp in 1861. Promoted to the rank of general in 1862, he visited Palestine and the East, and next year took his seat in the House of Lords. On 10th March, 1863, he was married in St. George's Chapel, Windsor Castle, to Princess Alexandra, eldest daughter of Christian IX of Denmark, and from this time onwards he discharged many public ceremonial functions. Attacked by typhoid fever in the winter of 1871, his life was for a time despaired of, but he recovered early in 1872, his recovery being made the occasion of a thanksgiving service in St. Paul's Cathedral. During 1875 and 1876 he visited India. He was a member of the Poor Law Commission of 1893. He promoted the establishment of the Imperial Institute as a

memorial of Queen Victoria's jubilee (1887), and he commemorated her diamond jubilee (1897) by founding the Prince of Wales's (now King's) Hospital Fund for the better financial support of the London hospitals. On the death of Queen Victoria on 22nd Jan., 1901, he succeeded to the throne, and was crowned on 9th Aug., 1902. King Edward did much to promote friendly relations with foreign powers, especially with France and the United States. It was through his personal influence that the Entente Cordiale with France was brought about. To him and Queen Alexandra were born: Albert Victor Christian Edward, Duke of Clarence and Avondale, born 1864, died 1892; George Frederick Ernest Albert, who succeeded his father as George V, born 1865, married 1893, to Princess Victoria Mary of Teck; Princess Louise, now Princess Royal, born 1867, married 1889, to the Duke of Fife, who died 29th Jan., 1912; Princess Victoria, born 1868; and Princess Maud, born 1869, married 1896, to Prince Charles of Denmark, now King of Norway as Haakon VII.—BIBLIOGRAPHY: *Life of the King*, by 'One of His Majesty's Servants'; Holt-White, *The People's King*; E. Legge, *King Edward in his true Colours*; J. P. Brodhurst, *The Life and Times of Edward VII*; W. H. Wilkins, *Edward the Peacemaker*.

Edward, Thomas, a Scottish naturalist, born 1814, died 1886. The son of poor parents, he was apprenticed to a shoemaker and worked at his trade till nearly the end of his life, but succeeded in acquiring much knowledge of natural history and some fame as a naturalist. An interesting biography of Edward (*Life of a Scottish Naturalist*), written by Samuel Smiles, appeared in 1876, and a pension of £50 a year was shortly afterwards conferred on him by Queen Victoria.

Edwards, Amelia Blandford, English novelist and Egyptologist, born in London in 1831, died in 1892. She gave early evidence of great literary ability by her contributions to periodicals, and attracted attention by her novel *My Brother's Wife* (1855). Among her best-known novels are: *Hand and Glove* (1859), *Barbara's History* (1864), *Half a Million of Money* (1865), *Debenham's Vow* (1870), and *Lord Brackenbury* (1880). Miss Edwards wrote also ballads and books of travel, and in 1882 founded the Egypt Exploration Fund and devoted herself to Egyptology, leaving funds to found a chair of Egyptology in University College, London.

Edwards, Bryan, English writer, born in Wiltshire in 1743, died in 1800. He inherited a large fortune from an uncle in Jamaica, where he long resided. His *History, Civil and Commercial, of the British Colonies in the West Indies* appeared in 1793.

Edwards, John Passmore, British philanthropist and journalist, born at Blackwater,

Cornwall, in March, 1823, died on 22nd April, 1911. Trained as a journalist, he became representative of the paper *The Sentinel*, and was opposed to the Corn Laws. In 1862 he bought *The Building News*, and in 1876 the London *Echo*, of which he was director for twenty years. Although somewhat unpopular on account of his opposition to the Boer War, he is remembered as a public benefactor, having founded numerous Passmore Edwards institutions, public libraries, and settlements, and contributed largely to hospitals. He was a delegate to the peace congresses at Brussels, Paris, and Frankfort (1848-50), and twice refused a knighthood.

Edwards, Jonathan, American theologian and metaphysician, born 5th Oct., 1703, died 22nd March, 1758. He entered Yale College in 1716, and studied till 1722, when he received a licence as preacher. In 1728 he was elected a tutor in Yale College, but resigned in 1726 to be ordained as minister at Northampton (Mass.). After more than twenty-three years of zealous service here, he was dismissed by the congregation owing to the severity with which he sought to exercise church discipline. He then went as a missionary among the Indians at Stockbridge, in Massachusetts. Here he composed his famous work on the *Freedom of the Will*, which appeared in 1754. In 1757 he was chosen president of the college at Princeton, New Jersey, but died shortly afterwards.

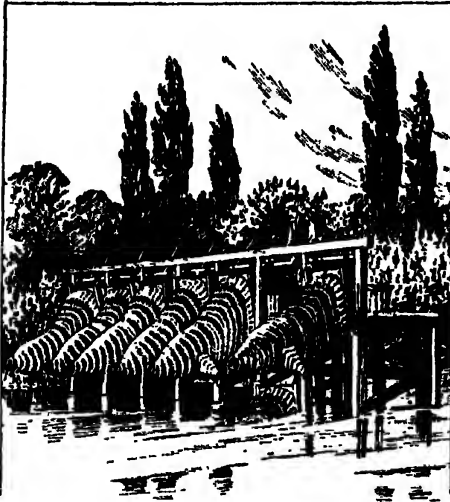
Edwy, King of England, son of Edmund I, succeeded his uncle Edred in 955. Taking part with the secular clergy against the monks, he incurred the confirmed enmity of the latter. The Papal party, headed by Dunstan, was strong enough to excite a rebellion, by which Edwy was driven from the throne to make way for his brother Edgar. He died in 959, being probably not more than eighteen or nineteen years old.

Eecloo (Æk-lō'), a town, Belgium, province of East Flanders, 11 miles north-west of Ghent, the seat of textile manufactures. Pop. 13,536.

Eel, the popular name of fishes belonging to the teleostean sub-order Apodes. The common eel (*Anguilla vulgaris*) is the type of a special family (Anguillidae) and has a very wide distribution in the fresh waters of the globe. It is snake-shaped, devoid of ventral fins, and the minute scales are embedded in the slimy skin. When five or six years old it migrates to the deep sea for spawning, after which it probably dies. Curious flattened larvæ (Leptocephalus) hatch out from the floating eggs, and undergo a metamorphosis to become young eels or elvers, which when a year old ascend rivers in vast numbers as 'eel fare'. Eels are esteemed as an article of food, and even elvers are compressed into a sort of cake. In England river eels are caught in great numbers by means of eel-bucks



or eelpots, traps consisting of a kind of basket with a funnel-shaped entrance composed of willow rods converging towards a point, so that the eels can easily force their way in but cannot return. A stocking or tube of coarse cloth hanging from an aperture of a box down into the interior is also used. In England a kind of trident called an *eel-spear* is used also for taking them. A fisherman wades to the shallows, and, as he strikes his spear in the mud in every direction around him, the eels reposing on the bottom are caught between the prongs. They are also taken by hooks and lines and in other ways.



Eel-bucks on the Thames

See *Conger-eel*; *Muræna*. Electric eels belong to another group. See *Electrical Fishes*.

*Effen'di*, a Turkish title which signifies lord or master. It is particularly applied to the civil, as *aga* is to the military officers of the Sultan. Thus the Sultan's first physician is called *Hakim effendi*, and the priest in the seraglio *Imam effendi*.

*Effervescence*, the rapid escape of a gas from a liquid, producing a turbulent motion in it, and causing it to boil up. It is produced by the actual formation of a gas in the liquid, as in fermentation, or by the liberation of a gas which has been forced into it, as in aerated beverages.

*Efficiency*, in mechanics and engineering, the ratio of the useful energy given out by a machine to the energy supplied to it. Energy cannot be created or destroyed, but it may assume various forms, and, within limits, can be changed from any one of these forms to any other. A machine or engine is an apparatus for converting energy in some given form into energy in another

assigned form. In practice it is found impossible to convert the whole of the given energy into the form wanted, there being always a residue which is not of the right kind, and is, therefore, counted as useless. The smaller the residue, the more efficient is the machine. In the machines of elementary mechanics, such as the lever or the screw, the energy supplied is work done by the power or effort, and the energy wanted is work done on the load. If  $E$  is the effort, and  $W$  the load, then if there were no friction we would have  $E = Wr$ , where  $r$  is the velocity ratio, or ratio of the velocities of the points of application of load and effort. The relation found by experiment, however, is usually of the type  $E = Wr + C$ , where  $C$  is a constant. The efficiency is the fraction  $Wr/E$  or  $1 - C/E$ , so that it increases with the load. In *heat engines*, energy in the form of heat is converted into mechanical energy. Heat is taken in at the source, part of it is changed into mechanical energy, and the remainder is rejected to the condenser. According to the second law of thermodynamics, the efficiency of such an engine has a definite upper limit which it cannot exceed, this being the ratio of the difference of the temperatures of the source and the condenser to the temperature of the source, these temperatures being measured on the absolute scale, that is, from  $-273^{\circ}\text{C}$ . reckoned as the zero. The efficiency of a steam-engine is usually compared with that of an ideal engine working between the same temperatures, and going through a definite periodic set of operations called the Rankine cycle. If the thermal efficiency of an actual engine is 27 per cent, and that of an ideal engine working on the Rankine cycle is 30 per cent, obviously the important figure is the ratio of 27 to 30, or 90 per cent.

The performance of a steam-engine depends, not only on its *thermal efficiency*, but also on its *boiler efficiency* and its *mechanical efficiency*. The boiler efficiency is the percentage of the heat obtainable from the fuel consumed which is actually used in the engine; in a good boiler it may be 75 per cent. The mechanical efficiency is the ratio of the work given out at the crankshaft to the work done on the piston; in other words, it is the ratio of brake horse-power to indicated horse-power. It may perhaps be 80 per cent. To arrive at the over-all efficiency, the various partial or component efficiencies must be multiplied together. In comparing one type of engine with another, what is important is obviously this over-all efficiency, or ratio of energy output to the theoretical energy value of the fuel employed. Thus, to take the case of marine engines, the Diesel oil-engine is inferior to the turbine and to the reciprocator in point both of thermal and of mechanical efficiency.



But when the efficiency of the boilers is taken into account, the Diesel comes out very decidedly ahead of the others. Taking coal at 10,000 British thermal units per pound, and Diesel oil at 18,000 British thermal units per pound, Mr. T. R. Wollaston has given the following figures for the number of British thermal units consumed per brake horse-power hour: steam-engine 19,000; steam turbine 21,000; gas-engine 15,000; Diesel engine 9000. Electrical plant in general reaches a high standard of efficiency. Some figures are: transmission lines 85 to 95 per cent; motors and generators at full load 70 to 80 per cent from 1 to 5 h.p., 80 to 90 per cent from 5 to 50 h.p., and 95 per cent for large sizes. Electrical transformers are the most efficient of all machines. Their efficiency ranges from about 90 per cent in small sizes, up to perhaps 98.5 per cent for large machines at full load. See *Energy; Internal-combustion Engines; Steam-engines; Thermodynamics*.

**Efflorescence**, the property which certain hydrated salts have of losing water when exposed to air. Thus washing-soda,  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ , if left in air becomes opaque, loses its crystalline appearance, and finally falls to a powder by loss of water. The term is also applied in botany to the process of flowering.

**Effluents**, a general term applying to liquids, on being discharged, after undergoing some form of treatment. The term is more particularly applied to the purified liquid discharged into rivers and streams from sewage-works, the crude sewage having been freed of the grosser solids, and rendered clear and innocuous to animal and vegetable life.

**Effodientia**, the name proposed for a new order of mammals to include pangolins and aard-varks. See *Edentata*.

**Égalité**, Philippe. See *Orleans, Louis Philippe Joseph*.

**Egbert**, considered the first king of all England, was of the royal family of Wessex. He succeeded Brihtic in 802 as King of Wessex. He reduced the other kingdoms and rendered them dependent on him in 820, thus becoming their overlord. He died in 839.

**Egede**, Hans (ä'ge-dä), the apostle of Greenland, born in 1686 in Norway, died in 1758. In 1721 Egede set sail for Greenland with the intention of converting the natives to Christianity, and for fifteen years performed the most arduous duties as missionary, winning by his persevering kindness the confidence of the natives. In 1736 he returned to Copenhagen, where he was made a bishop and director of the Greenland Missions.

**Eger** (ä'ger), a town of Bohemia, Czechoslovakia, on a rocky eminence above the Eger, 91 miles west of Prague; once an important fortress, though now quite dismantled. It has

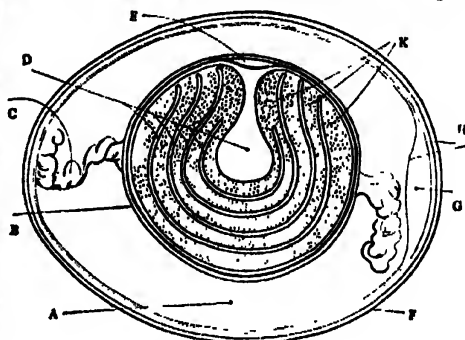
manufactures of woollens, cottons, leather, and soap. Wallenstein was assassinated there (1684). Pop. 26,820.

**Egeria**, a nymph who received divine honours among the Romans. Numa is said to have received from her the laws which he gave to the Romans.

**Egersund** (ä'ger-sund), a seaport on the south-west coast of Norway, some distance south of Stavanger, and connected with it by railway, has a large pottery-work, fishing and shipping trade. Pop. 3500.

**Egerton, Francis**. See *Bridgewater, Duke of*.

**Egg**, (1) in the narrower sense, the female reproductive or germ-cell, which after impregnation or fertilization by a male germ-cell (sper-



Section of Hen's Egg

A, White or albumen. B, Vitelline membrane. C, Chalaza. D, White yolk. E, Germinal disc. F, Shell. G, Air space. H, Shell membrane. K, Yellow yolk.

matozoon or sperm) develops into an embryo. (See *Ovum*.) (2) The term is applied, more broadly, to a more complicated reproductive body that consists of an ovum together with supplementary parts. The egg of a bird, for example, includes the fertilized and developing ovum (yolk), nutritive white (albumen), and protective double egg membrane covered by a porous calcareous shell. The eggs of animals lower than the birds have usually only three parts, viz. the germinal spot or dot, the germinal vesicle, and the vitellus or yolk; the first being contained in the vesicle, and that again in the yolk. The common domestic fowl, the turkey, the pea-hen, and the common duck produce the eggs which are commonest in the market. The eggs of the green plover (*Vanellus cristatus*) are esteemed as a delicacy. The hard roes of fishes are the ovaries, containing innumerable eggs (over nine millions in the cod). The salted hard roes of the sturgeon are known as caviare. A hen's egg of good size weighs about 1000 grains, of which the white constitutes 600, the yolk 300, and the shell 100. When the white of an egg is warmed it coagulates to a firm opaque

mass. Eggs form an important article in British commerce; the number imported in 1919 amounted to the value of £8,613,000, mainly from Russia, Denmark, Austria, France, and Italy.

Egg, an island of Scotland. See *Eigg*.

Egga, a town of N. Nigeria, on the right bank of the Niger, about 70 miles above the junction of the Benue. Pop. 10,000.

Eggar, or Egger, a name given to moths of the family *Lasiocampidæ*. *Lasiocampa trifolii*, a well-known British moth, is called the grass-egger, and the *L. quercus* the oak-egger, from the food of their caterpillars.

Egg-bird, or Sooty Tern (*Sterna fuliginosa*), a bird of considerable commercial importance in the West Indies, as its eggs, in common with those of two other species of tern, form an object of profitable adventure to the crews of numerous small vessels.

Eggleston, Edward, American novelist and miscellaneous writer, born in 1837, died in 1902. He entered the ministry of the Methodist Church, was engaged in pastoral work for some years, afterwards as pastor of an independent church founded by himself. He wrote and edited much, among his books being: *The Hoosier Schoolmaster* (1871), which first appeared in *Hearth and Home*; *The End of the World*; *A Love Story*; *Roxy*, a highly popular novel (1878); *The Hoosier School-boy*; *The Graysons*; *Household History of the United States*; *The Faith Doctor*. His novels are marked by abundance of incident, skilful handling of dialect, and realistic portraiture.

Egg-plant, or Brinjal (*Solanum melongena*), nat. ord. Solanaceæ, an herbaceous plant, from 1 foot to 18 inches high, with large white or purplish flowers. The fruit is about the size of a goose's egg, and generally yellow, white, or violet, and when boiled or stewed is used as an article of food. It is cultivated in India, the United States, &c., and in European hothouses. There are several other species of egg-plants, as *S. indicum* and *S. sodomæum*.

Egham, an urban district of England, county of Surrey, on the Thames opposite Staines, about 21 miles from London, with the Royal Holloway College for women, and the Holloway Sanatorium. Near it is Runnymede, where King John signed Magna Charta.

Egil Skallagrím, an Icelandic bard or poet of the tenth century, who distinguished himself by his warlike exploits in predatory invasions of Scotland and Northumberland. Having fallen into the hands of a hostile Norwegian prince, he procured his freedom by the composition and recitation of a poem called *Egil's Ransom*, which is still extant.

Eginhard, or Einhard, friend and biographer of Charles the Great (Charlemagne), born in Maingau (East Franconia) about 770, died in

840. He was educated in the monastery at Fulda, and his capacity attracted the attention of Charles, who made him superintendent of public buildings, and of whom he became the constant companion. He also enjoyed the favour of his son Louis the Pious. His later years were passed at Mülheim-on-the-Rhine, where he founded a monastery. His *Vita Caroli Magni* is a work of great value, and his letters are also important.

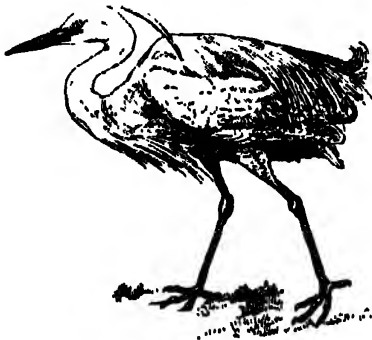
Eg'lantine, one of the names of the sweet-brier (*Rosa rubiginosa*), a kind of wild rose. The name has sometimes been erroneously used for other species of the rose and for the honeysuckle.

Eg'mont, Lamoral, Count, Prince of Gavre, was born in 1522, of an illustrious family of Holland. He adopted a military career, accompanied Charles V in his African expeditions, and distinguished himself under Philip II in the battles of St. Quentin (1557) and Gravelines (1558). Philip having gone to Spain, Egmont soon became involved in the political and religious disputes which arose between the Netherlands and their Spanish rulers. He tried to adjust the difficulties between both parties, and in 1563 went to Spain to arrange matters with Philip. He was well received, sent back with honour, but quite deceived as to the king's real intentions. In 1567 the Duke of Alva was sent with an army to the Netherlands to reduce the insurgents. One of his first measures was to seize Count Egmont and Count Horn. After a trial before a tribunal instituted by Alva himself they were executed at Brussels 5th June, 1568. A well-known drama of Goethe's is founded on the story of Egmont.

E'goism, as a philosophical doctrine, the view that the elements of all knowledge and the reality of the things known are dependent on the personal existence of the knower. This theory is also called Subjective Idealism or Solipsism. It maintains that his individual ego is the only being that a man can logically assert to exist. As an ethical theory (practical egoism) it is the opposite of altruism. It maintains that the governing principle of conduct for the individual is his own good on the whole, and that self-interest is the basis of morality. Egoism is to be distinguished from egotism, which denotes the practice of putting forward or dwelling upon oneself, of thinking, talking, or writing about oneself.

Egremont, a town of England, in Cumberland, in the valley of the Ehen, 3 miles from the sea, giving name to a parliamentary division. It has ruins of an ancient (twelfth century) castle associated with a legend that served Wordsworth as the subject of a poem. Iron-ore and limestone are worked. Pop. 6300.

Eg'ret, a name given to those species of white herons which have the feathers of the lower part of the back elongated and their webs disunited, reaching to the tail or beyond it at certain seasons of the year. Their forms are more graceful than those of common herons. The American egret (*Ardéa egretta*) is about 37 inches long to the end of the tail; plumage soft and blended; head not crested; wings moderate; the tail short, of twelve weak feathers. The European egret (*A. alba*)

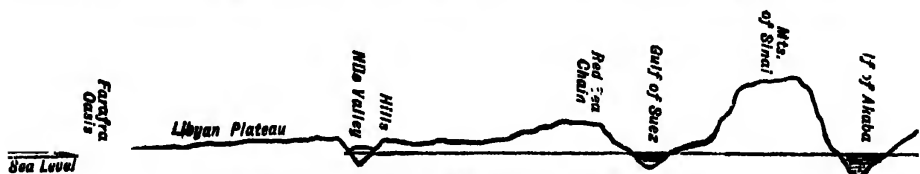


Little Egret (*Ardia garzetta*)

is about 40 inches long, of a pure white plumage; the bill is black or dark brown, yellow at the base and about the nostrils, and the legs are almost black. The little egret (*A. garzetta*) is about 22 inches long from bill to end of tail, the plumage is white. The term egret is used in the feather trade for a bunch of the loose plumes, valued as an ornament.

Egypt (from Gr. *Aiguplos*) is, as Herodotus has said, "the gift of the Nile". This great river, about 4000 miles in length, rises as the White Nile, three degrees south of the equator, drawing its waters from the Central African lakes.

a ridge of intercepting granite crops up. At Edfu, about 68 miles farther north, the limestone formation is entered, and the Nile then flows uninterrupted between flanking hills that here and there attain the height of 1000 feet. Egypt proper extends from Assouan to the Mediterranean. At a distance of about 100 miles from the sea the Nile divides into the branches forming the Delta. To the south of Cairo it sends out the Bahr Yusuf, a branch about 200 miles long, which flows into the fertile Fayum. The narrow valley, the average breadth of which is 10 miles, is 'the land of Egypt'. Its cultivable area is not so large as Belgium, being under 10,000 sq. miles in extent. Rain falls to the north of Cairo, but in Upper Egypt there are showers only once in every three or four years. The fertility of the country is due to the Nile. Each year the great river rises in flood when the equatorial lakes are suddenly swollen by heavy tropical rains and the snow melts in the Abyssinian mountains. The mean summer heat is 83° F. in the Delta and 122° F. in the valley. It is a dry heat, not so oppressive as that of India, and malaria is practically unknown. The most trying part of the year is during the period of 'Low Nile'. Before the surplus waters were stored in the Assouan Dam, the river shrank so low that its flow seemed uncertain. For about two months the hot and blistering 'hanseen' (or 'sand-wind') keeps blowing. A new season is ushered in by the cool north wind—the Etesian wind of the Greeks—which clears the accumulated dust from vegetation. It is lauded in ancient texts by priestly poets and Pharaohs. About the same time the conspicuous star Sirius makes its appearance. It was anciently regarded as a form of the Mother Goddess. On the 'Night of the Drop', in June, a fertilizing tear was supposed to fall



Diagrammatic Section across Egypt from Farafra Oasis to Sinai

To the south of Khartoum, and 1850 miles from the sea, it is joined by the Blue Nile, which rises in the mountains of Abyssinia, and about 140 miles farther on it is fed by the Atbara, its last tributary. On the tableland of Nubian sandstone between Khartoum and Elephantine the river forms two great loops, and is intercepted by shallows or cataracts, of which there are six in all. The 'first cataract'—the last on the journey northward—is at Assouan, where

from this star, and thereafter the 'new Nile' was born. For about four days (before the Assouan Dam was constructed) the rising river flowed green, the slimy matter on the marshes of Upper Egypt being pushed forward by the 'new water'. This was the 'Green Nile'. Then the Nile turned blood-red with Abyssinian clay. This was the 'Red Nile'. As soon as the fertilizing 'new water' touched the parched sands, Egypt awoke to new life. Countless

insects appeared, new grass and flowers sprang up, and trees and shrubs broke into brilliant blossoms that filled the air with sweet perfume. Bursting over its banks, the steadily rising river flooded the valley generously and refreshingly. According to the Coptic Calendar, the inundation season lasted from June till September, the seed-time from October till January, and the harvest began in February.

*Early Religion and Civilization.*—In its earliest



Part of the Hieroglyphic Legend of Heru-Behutet and the Winged Disk, cut on the Walls of the Temple of Edfu in Upper Egypt

Translation: In the three hundred and sixty-third year of Ra-Heru-Khuti, who liveth for ever and for ever, His Majesty was in TA-KENS, and his soldiers were with him; (the enemy) did not conspire (auu) against their lord, and the land (is called) UAUATET unto this day. And Ra set out on an expedition in his boat, and his followers were with him, and he arrived at UTHES-HERU, (which lay to) the west of this nome, and to the east of the canal PAKHENNU, which is called (. . . to this day). And Heru-Behutet was in the boat of Ra, and he said unto his father Ra-Heru-Khuti (i.e. Ra-Harmachis), "I see that the enemies are conspiring against their lord: let thy fiery serpent gain the mastery . . . over them"—Reproduced by permission from Vol. XXXII of *Books on Egypt and Chaldaea*, by Sir E. A. Wallis Budge.

phases the religion of ancient Egypt reflected the natural phenomena of the Nile Valley in their relation to the needs, experiences, and achievements of mankind. The flood was an annual 'miracle of mercy', and the early people tried to account for it. They concluded it was a gift of the gods. It ensured the food-supply; it brought health and relief from the oppressive heat endured when the sand-wind prevailed and the river was low. The new water was 'the water of life'; it fertilized the parched soil and caused barley and millet (which grew wild in the Delta) to spring up, trees to yield fruit, and curative herbs to appear on the river banks. In the prehistoric period the Nile was identified with Osiris, who, according to the traditions of the Delta people, once reigned as their king, and introduced the agricultural mode of life which made it possible for large and growing

communities to dwell in the narrow valley. In the Pyramid Texts (c. 2700 B.C.) Osiris is the controller of the Nile, the principle of life in the Nile, and the Nile itself. In one of his phases the god is the 'Green One'—the Green Nile. A Pyramid Text reads: "Horus comes! He beholds his father in thee, Green One, in thy name of Water of Greenness". The soul-substance (literally 'the seed') of Osiris was the vital principle in the green or new water. Osiris was the serpent-soul in the water, and the serpent (leviathan) of the ocean which 'encircled the netherworld'. The god is addressed in a Pyramid Text: "Thou art great, thou art green in thy name of Great Green" (Mediterranean Sea). Osiris was slain by Set, and his life-blood was the Red Nile, which entered the soil and vegetation. Osiris was not regarded as the Green One because vegetation is green; the ancient Egyptians appear to have attributed the greenness of vegetation to the Green Nile, the soul-substance of Osiris. The sap of shrubs and trees was 'Blood'—the blood of the god. Osiris continued to live after death. On earth he was in barley, fruit, &c., and in the fertilized soil. He was in the other world Judge and King of the Dead. In his underworld Paradise the souls of the dead grew corn and cultivated fruit-trees—the 'food of life'. The Osirian cult had origin in the Delta of Lower Egypt. In Upper Egypt a solar cult exalted Horus, the falcon god, as chief deity. Their heaven was beyond the sky 'to the east'. In the Pyramid Texts there is clear evidence that the solar cult believed the souls of the dead went eastward, while the Osirian cult believed they went westward. Osiris was called 'First of the Westerners', The 'Easterners' of the south (Upper Egypt) conquered the 'Westerners' of the north (Lower Egypt), and Egypt was united into a single kingdom by the traditional King Mena, with whom begins the dynastic history of Egypt. This conquest appears to have been due to the introduction of copper weapons.

The idea that the Horites were invaders from Arabia or Mesopotamia has been abandoned. Copper was anciently found in the wadis of Upper Egypt and on the shores of the Red Sea. After boat-building and navigation were well advanced copper was mined in Sinai. According to Egyptian evidence, Edfu was the centre of the early copper industry and of the Horus cult. As Egyptian copper is naturally hard, it required no amalgam. Egypt, therefore, never had a Bronze Age, nor had it a Neolithic Age. The copper artifacts were imitations of Palaeolithic forms of the Solutrian type. After the conquest there occurred fusions of religious cults. Local pantheons reflected local politics. But although the sun-cult of Heliopolis exalted Ra

(or Re) as King of the Gods, the belief that all that existed originated in water persisted till the end. The water-mother was Hathor, who gave birth to Osiris. As the Nile was supposed to come from heaven, she was the sky-goddess; her animal was the primeval cow of a pre-dynastic cult, and she was the shell-spirit of water as well—the Egyptian Aphrodite. The shell, pearl, cow, sky, sun, moon, and stars were connected with Hathor as Nut. Ra, the sun-god, was, like Osiris, regarded as her son. Her attributes were in time absorbed by Isis. At the dawn of the Dynastic Age the religious beliefs of the Egyptian peoples were already well developed, the agricultural mode of life was established in the Nile Valley and in the Delta area, the calendar had been introduced, while copper weapons and implements were in use. The subsequent history of the official religion has a political aspect. Local cults rose into prominence as a city-state or ruling family achieved political ascendancy. Memphite theology and the Memphite god Ptah (the god of artisans) assumed importance when the city of Memphis became the capital of the united kingdom. Heliopolis ('the city of the sun') was the northern centre of the solar cult, which, during the fourth and fifth dynasties (c. 2900–2625 B.C.), became influential enough to impose its theology on the court. The popular Osirian faith was absorbed. Pharaohs were 'Sons of Ra', the sun-god, and Ra supplanted the southern sun-god Horus. Before the Pyramid Age the Osirian and Horite cults had been blended, and Horus became the son of Osiris. Although the living Pharaoh, however, was the son of Ra, he was also a Horus; after death he became an Osiris. The culture-blending process introduced many complexities. During the twelfth dynasty (2000–1788 B.C.) the name of the Theban god Amon entered into



Painted inner wooden coffin of Pen-Amen-Neb-Nest-Taui, a prophet of the God Amen and of the Goddess Bast at Thebes.

royal names. But the permanent political ascendancy of Amon of Thebes really followed upon the expulsion of the Hyksos military aristocracy about 1580 B.C. By this time the northern sun cult's influence had become sufficiently strong to have Ra blended with the Theban deity who was subsequently known as Amon-Ra. Before the close of the eighteenth dynasty (c. 1350 B.C.) a royal sun cult, promoted by Pharaoh Akhenaton (Amenhotep IV), exalted Aton, the sun-disc, as sole god of Egypt and the rest of the world. The Amon-Ra cult regained its political ascendancy with the rise of the nineteenth dynasty. In later times the chief gods of the reigning families were blended forms of Amon, Ra, Ptah, and Osiris. Not only the gods, but the rival Paradises, were blended. Osiris's underworld Paradise was transferred to the mythical other world beyond the horizon, and the sun-barque of the sun-god, which carried the soul of the Pharaoh, was supposed to touch at 'the port of Paradise'. It went westward and passed through the under-world, and emerged again next morning at dawn in the east. The contradictions in the Egyptian religious texts are believed to be mainly due to the blending of beliefs regarding the fate of man which were originally fundamentally different. Local deities were embraced in the official theology, but at their centres remained prominent and influential. But these, too, were in time so strongly in-



Types of Columns from Egyptian Temples

fluenced by the solar and Osirian faiths that they suffered in no small degree loss of identity except in name. The religious beliefs of Egypt as a whole were never completely systematized. There were no heresies because there were no orthodox beliefs. Any religious cult was toler-

ated, so long as it acknowledged the supremacy of the god or pantheon of the ruling family. In the later period the cult of Serapis (Asar Hapi), the bull form of Osiris, was popular.

*Arts and Crafts.*—Art developed in ancient Egypt under religious patronage. The earliest use made of Nubian gold was in manufacturing imitation luck-shells worn by the pre-dynastic peoples. Gold thus acquired a religious significance; at an early period it was associated with the sun-deity—the mother-goddess in her solar aspect was called 'Golden Hathor'. The hieroglyph for gold (*nub*) is a collar of beads. Exquisite gold ornaments in symbolic shapes were produced during the early dynasties. No

The sculptors were using the hardest material by the time of the Pyramid Age (c. 2700 B.C.). A great tomb-statue of Pharaoh-Khafa, in diorite, preserved in the Cairo Museum, is one of the triumphs of Egyptian sculpture. The Empire-period sculpture reached a high level of excellence. It was to provide 'soul-bodies' for dead Pharaohs that these great works of art were produced. A great advance in the manufacture of pottery was achieved during the Pyramid Age, when the potter's wheel was invented. To Egypt the ancient world owed this notable contrivance. It was introduced in time into Babylonia, Iran, India, China, Crete, Greece, and Western Europe. Shipbuilding is another



Egyptian Pottery-making

From a wall-painting in the tombs of Beni-Hassan.

finer gold ornaments have ever been produced anywhere than those of the twelfth dynasty (c. 2000 B.C.). These include chased gold pectoral ornaments and coronets and crowns inlaid with stones. When copper was first introduced it was used like gold. After implements were made of copper, vases of alabaster, diorite, &c., were worked with increasing skill and taste. The hardest stone was hewn and dressed for building purposes. No people have ever shown greater skill than the Egyptians in their stonework. The sculptors set themselves, when constructing temples, to imitate in stone the lashed palm-sticks, reeds, and papyrus stems used in the earliest shrines to stiffen the mud walls. \* Massive temple pillars were decorated with lotus petals, rose petals, &c. The early artists, who carved ivory, began to work in stone after copper implements were invented, and produced low reliefs in temples and tomb-chapels. Statuary in limestone, wood, and copper in the early dynastic period was vigorous and realistic.

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Egyptian industry which promoted progress. Cretan and Phœnician vessels were of Egyptian design. In all histories of shipping and navigation the ancient Egyptians are credited with being the pioneers of maritime enterprise. The custom of mummification arose in Egypt, and promoted the study of anatomy. Surgery had its origin in mummification, as astronomy had in astrology, and chemistry had in alchemy. Connected with each temple were architects, artists and sculptors, metal-workers and dyers. Ships were constructed to obtain wood for temples and to import pearls, precious stones, herbs, incense-bearing shrubs and trees, &c., for religious purposes. In the history of early civilization the Egyptian priests play a prominent part as patrons of the arts and crafts.

*History.*—In the hot, dry sands of Upper Egypt, which preserve the dead from decay, have been found the bodies of large numbers of pre-dynastic Egyptians. They were of the type known as the 'Mediterranean race'. The

contents of their stomachs have yielded husks of barley and millet and fragments of mammalian and fish bones. Circumcision was practised, and some men shaved. These people used malachite as an eyelid paint. When they discovered that copper could be extracted from malachite, it was used at first like gold, as has been stated. The production of copper implements and weapons was followed by the conquest of Lower Egypt by the copper-using Upper Egyptians.



Nefert, a royal princess of the Old Kingdom period

From a limestone statue in the Cairo Museum.

After the latter moved north, they found that the bodies of their dead decayed, and the practice of mummification was introduced. Before 3000 B.C. the broad-headed, long-bearded Armenoid type began to filter into Lower Egypt. The blending of Armenoids and Arabians in Syria produced 'the hybrid race of Semites'. In Egypt the ethnic fusion was most marked at the commercial capital, Memphis, and especially during the time of the pyramid builders (c. 2900-2750 B.C.). The spread of 'copper culture', and the importation into Egypt of timber from Lebanon, apparently brought the ancient races into close contact. Withal, shipbuilding and the art of navigation had advanced by leaps and bounds. Before the Pyramid Age there

were sea-traders on the Mediterranean, and the Egyptians imported copper from Sinai across the Red Sea. The legendary Pharaoh who united Upper and Lower Egypt was Mena or Menes. From his time (c. 3400 B.C.) till the close of the sixth dynasty (c. 2475 B.C.) the capital was Memphis. This period is known as that of the 'Old Kingdom'. Among its outstanding monarchs were Khufu, Khafra, and Menkure of the fourth dynasty, the builders of the largest pyramids. Herodotus refers to them as *Cheops*, *Chephren*, and *Mykerinos*. The 'Middle Kingdom' begins with the rise of Thebes in Upper Egypt as the centre of political power. During this period the nobility became so influential that the Pharaohs had to recognize their rights and privileges. In the period of the famous twelfth dynasty (c. 2000-1788 B.C.) the Theban monarchs established a uniform control of Egypt. The later kings of this dynasty were unable, however, to withstand the inroads of Asiatics, and the Middle Kingdom came to an end with the Hyksos invasion. Of the Hyksos, the so-called 'Shepherd Kings', little is known. They were civilized Asiatics, and during their overlordship of Egypt, which embraced the thirteenth till the seventeenth dynasties (c. 1800-1575 B.C.), the horse and chariot were introduced into Egypt. A Theban royal house rose into prominence during the latter part of their sway, and the Hyksos were finally expelled by Pharaoh Ahmose, who founded the eighteenth dynasty. The Empire period was then inaugurated. Egypt's greatest emperor, Thothmes III (1515-1461 B.C.), extended his conquests to the borders of Asia Minor, and received tribute from the Hittites, and even from Cyprus and Crete. During the reign of Akhenaton, the Hittites and their allies, the Amorites, seized the Egyptian sphere of influence in Syria and Northern Palestine.

In the nineteenth dynasty (1350-1205 B.C.) much of the lost territory was recovered. *Rameses II* (1325-1258 B.C.) fought his Waterloo at Kadesh, but found it necessary about 1300 B.C. to conclude a treaty of peace with the Hittites, the Assyrian Power at the time becoming very powerful and aggressive. *Rameses III* of the twentieth dynasty was the last great Pharaoh of the Empire period. He successfully resisted the threatened invasions of naval and military peoples from Greece and Anatolia in 1200 B.C. It is believed that the Trojan War (1194-1184 B.C.) was waged by the same confederacy which had attempted to invade the Delta region. No fewer than nine Pharaohs named *Rameses* ruled in Egypt after *Rameses III*. Most of these were priest-kings. A Libyan dynasty held sway for about two centuries (950-750 B.C.). One of its Pharaohs-Sheshonk



was the 'Shishak' who was an ally of Solomon; after the death of that monarch he invaded Palestine. The Ethiopians of Nubia (Sudan) subsequently overran Egypt. One of its Pharaohs, Shabaka, was the ally of King Hosea of Israel against Assyria; he was defeated at



Queen Ahmes (wife of Thothmes I)

From a relief on the wall of the temple at Der-el-Bahari. The face is of Mediterranean type. She represents the royal line which soon afterwards fused with a foreign strain, so that the racial type changed.

Raphia by Sargon in 720 B.C. The last Ethiopian Pharaoh, Taharka, was in 602 B.C. overcome by the invading army of the Assyrian Emperor, Ashur-banipal. The northern royal family of Sais then came into power, and the twenty-sixth dynasty, which lasted for about 130 years (602-525 B.C.), was inaugurated by Psamtik I. Pharaoh-Necho, referred to in the Bible, was the second ruler. It was during Necho's reign that his Phœnician mariners circumnavigated Africa. Egyptian culture was at the time spreading far and wide along sea and land routes. Trade was flourishing. The greatest world-power at the time, however, was Persia, and in 525 B.C. Egypt was conquered by Cambyses and became a Persian province, with short interruptions of weak native dynasties (the twenty-eighth to thirtieth), until in 332 B.C. Alexander the Great seized it and founded Alexandria. The Ptolemaic dynasty afterwards held sway for about three centuries. During this period learning and the arts flourished. Alexandria was not only a commercial town, but a centre of culture and the capital of Egypt.

Osiris was worshipped there in the form of Serapis. During the latter part of the dynasty the native Egyptians were using Greek and Græcized names, and the whole country was more or less Hellenized. The fifteenth Ptolemy was the younger brother of the famous Cleopatra, the seventh of her name. He vanished, and was succeeded by Cleopatra's son, Cesarion—Ptolemy XVI—whose father was Julius Cæsar. Both Cleopatra and her son perished when Egypt became a Roman province in 30 B.C. A daughter of Cleopatra and Antony became the wife of Juba, King of Morocco.

The Romans drew vast quantities of gold from the mines of Nubia (*nub* means 'gold') and made Egypt their 'granary'. Egyptian religious beliefs and customs were perpetuated by the Roman emperors. Tiberius and Vespasian restored ancient Nilotic temples. The worship of Isis spread to Rome. Hadrian had to give a decision in a dispute between Memphis and Heliopolis regarding the sacred bull. But Egyptian native learning was decaying, and the knowledge of hieroglyphic writing was dying out. Christianity was introduced during the Roman period, and the Coptic Church established. In A.D. 642 the Romans finally abandoned Egypt, which, till 868, became a province of the successive Mohammedan caliphates of Medina, of Damascus, and Baghdad. The Turkish soldiery dominated Egypt for a period. The Shia heretics afterwards became powerful, and the Christians were well treated. In 1250 the Mamelukes (descendants of slaves) came into power. Their pomp-loving sultans and emirs lived in great splendour. They came under Turkish sway early in the sixteenth century, but when Napoleon conquered Egypt in the eighteenth century



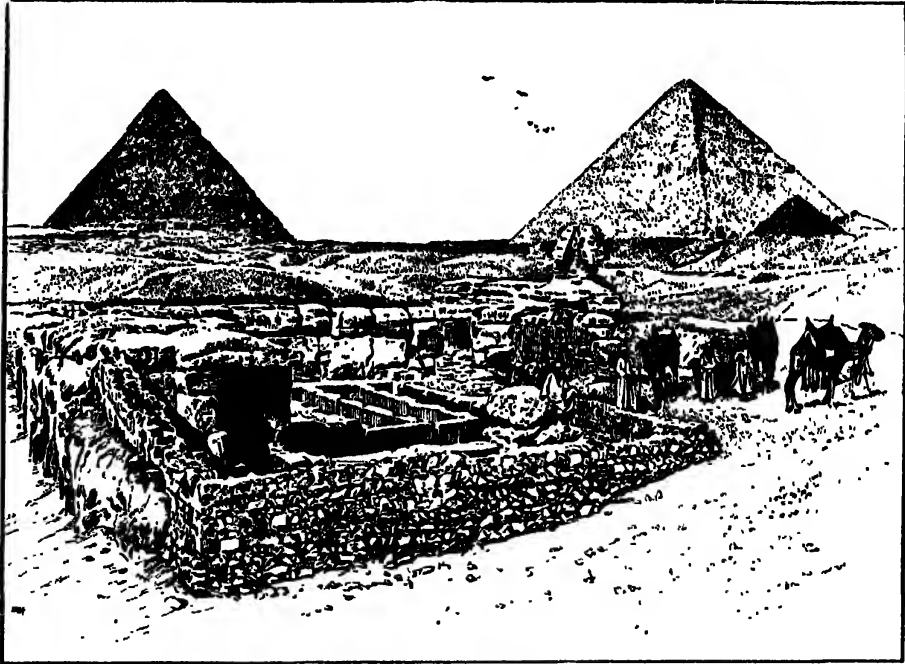
Head of Ramses II

From the mummy

they were again semi-independent. The British drove the French out of Egypt. Mehemet Ali, an Albanian officer in a Turko-Albanian force, had himself declared Sultan of Egypt, but when

he overran Syria and threatened to march to Constantinople, Russia intervened. Britain and France afterwards prevailed on Mehemet Ali to rule Egypt as the viceroy of the Sultan of Turkey. His successor and grandson, Abbas I, built the first railway in Egypt. The next viceroy, Said Pasha, son of Mehemet Ali, granted to a French company the right to construct the Suez Canal. Egypt became bankrupt under his successor, Ismail Pasha, the first Khedive (Prince), during whose reign the Suez Canal was

prophet great prestige. In Jan., 1884, General Gordon was sent to Khartoum as Governor-General of the Sudan, but was completely isolated there. Khartoum was captured and the gallant general slain on 26th Jan., 1885, before a relieving force could reach him. The Mahdi died in June, 1885, and was succeeded by Abdullah the Khalifa. After a period of reorganization and preparation in Egypt, the reconquest of the Sudan was begun. Lord (then Sir Herbert) Kitchener was Sirdar, or Commander-



The Great Pyramids of Giza and the Sphinx

Built by Cheops (Khufu) and Cephron (Khafra) as their future tombs, in order to secure immortality by the preservation of the mummy.

opened. He was deposed when the British and French took over the control of Egyptian finance. During the term of his successor, Tewfik Pasha, the Arabi Pasha rebellion took place. The military occupation of Egypt by British troops was followed by peace and good government. But trouble broke out in the Sudan. Mohammed Ahmed declared himself the Mahdi (Messiah) of the Mohammedans, and conquered a great part of the Sudan. In Nov., 1883, General Hicks ('Hicks Pasha') led an army of 10,000 Egyptians against the false prophet, but while marching across the driest part of the Sudan, misled by spies who acted as guides, his thirst-stricken army was entirely destroyed by the Mahdi's force. This victory gave the false

in-Chief of the Egyptian army, and his expeditionary force was strengthened by British regiments. In April, 1898, the Khalifa's army was defeated on the banks of the Atbara, and on 2nd Sept. Kitchener won a great victory near Omdurman. The Khalifa escaped, but was rounded up by Sir Reginald Wingate's force, and slain with his emirs at Umme Dubraykat on 24th Nov., 1899. Thereafter the Sudan came under the control of a British-Egyptian *condominium*, which appointed a Governor-General.

At the time of the outbreak of the Great War, in the autumn of 1914, the Khedive of Egypt was in Constantinople. He sided with the Central Powers. He was consequently deposed by Britain, and Prince Hussein Kamil

was declared Sultan of Egypt; the suzerainty of Turkey terminated at the same time. The new ruler of Egypt was the uncle of the deposed Khedive, Abbas Pasha Hilmi (second son of the first Khedive, Ismail Pasha, and brother of Tewfik Pasha, the second Khedive). Hussein Kamil died in 1917 and was succeeded by Ahmed Fuad Pasha. Under the Peace Treaty, Egypt is recognized as an independent kingdom protected by Great Britain. The capital of modern Egypt is Cairo, situated near the site of ancient Memphis. Thebes is represented by Luxor and Karnak.—BIBLIOGRAPHY: (Religion) Breasted, *Development of Religion and Thought in Ancient Egypt*; Renouf, *Book of the Dead*; Budge, *Gods of the Egyptians*; Wiedemann, *Religion of the Ancient Egyptians*; Sayce, *Religion of Ancient Egypt and Babylonia*; G. Elliot Smith, *The Migrations of Early Culture*; (History)—G. Elliot Smith, *The Ancient Egyptians*; Breasted, *A History of Egypt*; Flinders Petrie, *A History of Egypt*; King and Hall, *Egypt and Western Asia in the Light of Recent Discoveries*; H. R. Hall, *The Ancient History of the Near East*; Sir A. Colvin, *The Making of Modern Egypt*; Lord Cromer, *Modern Egypt*.

**Egyptian Blue**, a brilliant and very permanent pigment used by the Romans in the early centuries of the Christian era. It has been found in ancient frescoes in the Vatican, and also at Pompeii. The chemist Fouqué proved by analysis that it is a double silicate of calcium and copper.

**Egyptian Vulture** (*Neophron percnopterus*), a bird that frequents both shores of the Mediterranean, but rarely passes farther north, though it has been found in the British islands. It is one of the smaller vultures, about the size of a raven. The general colour is white, the quill feathers of the wing being dark brown. It frequents the streets of Eastern towns, where it is protected on account of its services as a scavenger. This vulture is sometimes known as Pharaoh's Hen, on account of its frequent representation in Egyptian hieroglyphics. In Spain it is called the *quebranta-huesos* (bone-smasher) in reference to its supposed habit of breaking up bones left by other vultures.

**Ehrenberg** (ä'ren-berh), Christian Gottfried, a German scientist, born in 1795, died in 1876. After studying theology, medicine, and natural history, he joined in 1820 an expedition to Palestine, Egypt, and Abyssinia, returning to Berlin in 1825. In 1829 he accompanied Humboldt to the Ural and Altai ranges and to Central Siberia. His great work on Infusoria appeared in 1838, and was at once recognized as the highest authority on the subject. It was followed in 1854 by his *Microgeology*.

**Ehrenbreitstein** (ä'ren-brit-stin), a dis-

mantled Prussian fortress formerly of great strength and situated opposite the confluence of the Moselle with the Rhine, on a precipitous rock 387 feet above the river, and inaccessible on three sides. It is connected with Coblenz on the opposite shore by a bridge of boats. The fortifications, which were erected between 1816 and 1826 at a cost of £1,200,000, could accommodate a garrison of 14,000 men, and possessed room for stores to last an army of 60,000 for a year.

**Ehrlich**, Paul, German physician, born in Silesia in 1854, died in 1915. Educated at Breslau, Strasburg, and Leipzig, he became *privatdozent* at the University of Berlin in 1889, and in 1896 was appointed director of the Royal Institute for Serum Research at Steglitz, which was transferred to Frankfurt in 1899, and became the Royal Institute for Experimental Therapeutics. His studies in the histology of blood are very important, but his claim to fame is based upon his discovery of *salvarsan* (606) and of *neosalvarsan* (614), arsenic compounds which are very efficacious in the treatment of syphilis. He delivered the Croonian lectures in 1900 and the Harben lectures in 1907, received honorary degrees from the universities of Oxford and Chicago, and in 1908 shared the Nobel prize for medicine with Metchnikoff of the Institut Pasteur in Paris. His works include: *Beiträge zu Histologie und Klinik des Blutes, Anämie, Abhandlungen über Salvarsan, &c.*

**Elbenstock** (l'ben-stok), a town in the south-east of Saxony, with important manufactures of lace. Pop. 9528.

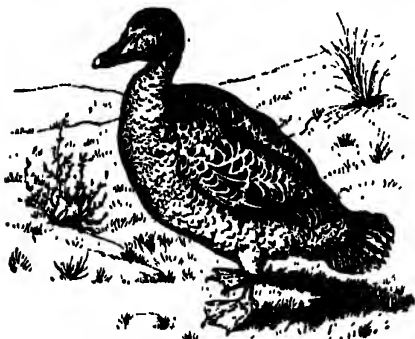
**Elchhorn** (l'h'horn), Johann Gottfried, German Orientalist, historian, &c., born in 1752, died in 1827. He became professor of Oriental languages at Jena, and then at Göttingen. Amongst his works are: *The Hebrew Prophets, History of Literature, History of the Last Three Centuries, Introductions to the Old and New Testaments and to the Apocrypha*.

**Eichstätt** (l'h'stät), an old town, Bavaria, in a deep valley of the Altmühl, 67 miles N.N.W. of Munich. Its principal edifice is a fine Gothic cathedral, founded in 1259. Pop. 8029.

**Eider** (l'dër), a river of Schleswig-Holstein, rises 8 miles S. of Kiel, and after a winding course falls into the North Sea at Tönning; length, 112 miles. By means of a canal it long gave communication between the North Sea and Baltic, but the new ship canal here has superseded this route.

**Eider Duck** (*Sonateria mollissima*), a species of duck found from 45° north to the highest latitudes yet visited, both in Europe and America. Its favourite haunts are solitary rocky shores and islands. In Greenland and Iceland they occur in great numbers, and also breed on the western

islands of Scotland. The eider duck is about twice the size of the common duck, being about 2 feet 3 inches in length, 3 feet in breadth of wing, and from 6 to 7 lb. in weight. The male is black, head and back white, with a black crown. The female is reddish drab spotted with black, and with two white bands on the wings. They feed largely on shell-fish and crustaceans. Their nests are usually formed of drift grass or dry seaweed, lined with a large quantity of down, which the female plucks from her own breast. In this soft bed she lays five eggs, which she covers over with a layer of down. If this, with the eggs, is removed, the bird repeats the process. One female generally furnishes about  $\frac{1}{2}$  lb. of down, but the quantity is reduced by cleaning. This down, from its superior warmth, lightness, and



Eider Duck (*Somateria mollissima*), female

elasticity, is in great demand for beds and coverlets; and the districts in Norway and Iceland where these birds abound are guarded with the greatest vigilance as a most valuable property. As found in commerce this down is in balls of the size of a man's fist, and weighing from 3 to 4 lb. It is so fine and elastic that 5 lb. of the best quality is sufficient for a whole bed. The down from dead birds is little esteemed, having lost its elasticity. The king eider duck (*Somateria spectabilis*) is another species resembling the preceding and inhabiting the same coasts.—Cf. J. G. Millais, *British Diving Ducks*.

Eiffel (à-fel), Alexandre Gustave, French engineer, born in 1832; attended, from 1852 to 1855, the École Centrale des Arts et Manufactures at Paris, and devoted himself chiefly to the designing of large structures in iron, especially bridges and viaducts, the great bridge over the Douro being one of his works. His name is best known, however, from the lofty iron tower erected by him in connection with the Paris Exhibition of 1889, rising to the height of 985 feet on the Champ de Mars. He was condemned in 1893 to two years' imprisonment and a fine of 20,000 francs for misappropriation of funds belonging

to the Panama Canal Company, but the judgment was set aside on technical grounds. In 1913 he published a work entitled *Resistance of the Air*. He died in 1923.

Eiffel Tower, a structure named after the originator, one of the sights of Paris, is by far the loftiest structure in existence, surpassing the Washington Obelisk, the next highest (555 feet), by 430 feet. It cost about £260,000, and was erected partly at the cost of the State, partly by funds provided by Eiffel himself, who formed a company for the purpose. The company derived its profits from the fees which visitors had to pay, but the tower became the property of the State in 1909. The top may be reached by stairs and lifts. The first stage or platform is at the height of 189 feet, and forms a quadrilateral 215 feet square, fitted up as a restaurant. The next platform is at the height of about 380 feet, and is 98 feet square. The third platform is at the height of 906 feet, and is large enough to accommodate a good number of persons, affording a magnificent view. The lantern higher up is supplied with powerful electric searchlights, and on the very summit is a small area utilized chiefly for scientific observations. The tower has been utilized in experiments connected with the fall of bodies, vibration of the pendulum, and pressure of the air. In recent years the tower has become an important wireless telegraphy station.

Eigg (eg), an island on the west coast of Scotland, county of Inverness, about 10 miles from the mainland, and 5 miles long by about 3 broad. It has bold, rocky shores, and terminates to the south in a lofty promontory called the Seuir of Eigg, with a peak of columnar pitchstone porphyry 1339 feet above the sea, and on one side perpendicular as a wall. It is the scene of the massacre, towards the end of the sixteenth century, of 200 Macdonalds by the Macleods of Skye, who suffocated them in a cave where they had taken refuge. Pop. 211.

Eight-hour Day. The eight-hour day was proposed in England as early as 1833, and in 1869 the Trade Union Congress of Birmingham formulated the demand that this ideal working day should be adopted throughout the United Kingdom. The Trade Unions and the Socialists sought to secure the establishment of the eight-hour day through legislation, and it gradually came into force not only in coal-mining, but in various trades and industries. The agitation in favour of an eight-hour day became very strong in Europe towards the end of the nineteenth and at the beginning of the twentieth centuries, and in England it was granted to miners in 1908, and to railway employees in 1919. Since the European War the movement has made great headway, and it now forms part of the pro-

gramme of the Labour parties in almost all European countries.—BIBLIOGRAPHY: Hedfield and Gibbins, *A Shorter Working Day*; Robertson, *The Eight Hour Question*.

**Eighty Club, The**, a club formed in 1879 by a number of prominent English Liberals with a view to the promotion of the success of Liberalism at the general election of 1880, whence its name. The members lecture on political subjects and address Liberal associations throughout the country. Women were first admitted to membership in 1920.

**Eikon Basilikē** (i'kon ba-sil'i-kē; Gr., 'the royal image'), the name of a book published shortly after the execution of Charles I in Jan., 1649, and supposed by some to have been written by the king himself. At the Restoration Gauden, afterwards Bishop of Worcester, laid claim to the authorship, and a memorandum in the copy of the Earl of Angelsea, Lord Privy Seal under Charles II, affirms his claim with the authority of Charles II and the Duke of York. The Royalist Clarendon, author of the *History of the Rebellion*, accepted this statement, but others refused to credit Gauden with the authorship. Within a year of its publication, 48,000 copies of the book were sold, and the republicans put forward Milton to answer it, his *Eikonoklastes* (that is 'image-breaker') appearing the same year, by order of Parliament. The *Eikon Basilikē* professes to be a sort of private journal of the king, written in an affectedly dignified strain, and containing numerous assertions of love for his misguided and ungrateful people.—Cf. Almack, *Bibliography of the King's Book, or Eikon Basilikē*.

**Eldon Hills** (el'don), a picturesque hill-mass with three summits, south of Melrose, Roxburghshire, Scotland, reaching a height of nearly 1400 feet, fabled to have been cleft in three by Michael Scott.

**Elleithyia** (i-li-thi'ya), the Greek name of the ancient Egyptian city Nekheb (the modern El-Kab), on the Nile, some distance above Esneh. Important remains have been obtained from rock-tombs in the neighbourhood, and there are several ruined temples.

**Ellenburg** (i'len-burh), a town, Prussian Saxony, 26 miles N.N.E. of Merseburg, on an island of the Mulde. It has manufactures of calico. Pop. 17,400.

**Elmbeck** (im'bek), or Einbeck, a town of Prussia, province of Hanover, 40 miles south of Hanover, once famous for its beer (*Elmbecker Bier*, whence *Bock*). Pop. 9430.

**Emmetsdale** (im'zē-dēln), a village and district, Switzerland, in the canton and 9 miles north by east of Schwyz, 3000 feet above the sea, celebrated for its Benedictine abbey. An image of the Virgin, alleged to possess miraculous powers,

annually attracts immense numbers of pilgrims. Pop. 8438.

**Einstein, Albert** (1879—), physicist, was born at Ulm, Württemberg, Germany, of German-Jewish parents. He was educated at the Gymnasium in Munich, and, on leaving school in his sixteenth year, accompanied his parents to Milan. Six months later, he enrolled at the Technical High School in Zurich, where he studied from 1896 to 1900. He held a post in the Swiss Patent Office from 1902 to 1909, then various professorships in Zurich till 1914, when he received a call to the Prussian Academy of Science, Berlin, as successor to van't Hoff. Einstein has been twice married. He has become famous as the author of the Theory of Relativity (q.v.). The 'special theory', which deals chiefly with electrodynamics and optics, was published in 1905, and the 'general theory' or theory of gravitation, about ten years later. His name became popularly known in 1919, after observations made during the solar eclipse of that year had verified his prediction of the bending of rays of light coming from a star and passing close to the sun. He has made other valuable contributions to Theoretical Physics, among these being a theory of the Brownian movements and various important applications of the modern quantum theory of energy. In 1921 he visited the United States and Britain, and delivered many lectures on Relativity.

**Eisenach** (i'zēn-äh), a town of Germany, in the former grand-duchy of Saxe-Weimar, near the mountains of Thuringia, at the junction of the Nesse and Ilmsel. It is an attractive town, and contains a palace erected in 1742. It has manufactures of pottery, leather, woollen yarn, &c. Sebastian Bach was born there in 1685. Near it lies the Wartburg, where Luther was kept for safety during 1521 and 1522. Pop. 38,382.

**Eisenberg** (i'zēn-berh), a town of Germany, former duchy of Saxe-Altenburg, with a palace and various manufactures. Pop. 10,750.

**Eisleben** (is'lā-bēn), a town, Prussian Saxony, 25 miles north-west of Merseburg, celebrated as the place where Luther was born and where he died. There are many memorials of Luther, and also a bronze statue of the reformer erected in 1883. Copper is extensively worked in the neighbourhood. Pop. 24,680.

**Eisner, Kurt**, Bavarian revolutionary leader, born in 1807 at Berlin, of a Jewish family. He studied at the University of Marburg, and early acquired a vast erudition. Entering journalism, he contributed to the *Frankfurter Zeitung*, where he published an article attacking the Kaiser. For this he was condemned to nine months' imprisonment. He then wrote for the Socialist press and eventually became editor-in-chief of

the *Vorwärts*. In 1907 he published a work entitled *The Fall of the Empire* which attracted much attention, and in 1910 he attacked Prussian ascendancy in the *Munich Post*. Eisner took an active part in the Revolution of 1918, and was appointed Prime Minister of Bavaria. A revolutionary and a Socialist, he was, however, opposed to Bolshevism, which he did not hesitate to criticize violently. But his policy of separation, his aim of liberating the South German States, and his constant attacks upon the Kaiser and the whole military caste of Germany, brought him many enemies. Whilst on his way from his house to the Foreign Office he was shot at and killed by Count Arco Valley on 21st Feb., 1919.

Eisteddfod (I-steth'vôd; W. *eistedd*, to sit, and *bod*, to be; pl. *eisteddfodau*), an ancient assembly of Welsh bards for the purpose of musical and poetical contests, the judges being originally appointed by commissions from the native princes, and after the conquest from the English kings. There are two kinds of eisteddfodau, the national or general, and the provincial gatherings which take place in many parts of Wales. The last commission was issued by Queen Elizabeth in 1568, but the eisteddfod fell into abeyance during the seventeenth century. In 1798 the ancient custom was revived by the Gwynnedigion Society, and on a more elaborate scale by the Cambrian Society, which grew out of the Gwynnedigion. Eisteddfodau are now held annually in North and South Wales alternately, and are attended by many thousands of people. The festivals of 1919 and 1920 were held at Corwen and at Barry, Glamorgan, respectively.—Cf. Rhys and Brynmor Jones, *The Welsh People*.

Eject'ment, in law, an action wherein the title to lands and tenements may be tried and the possession recovered. It is commenced by a writ addressed to the tenant in possession and all entitled to defend the possession, bearing that the plaintiff lays claim to the property in question, and calling upon all interested to appear within a certain time to defend their rights. In its older form the action was remarkable for the curious fictions on which procedure was based. The names of John Doe, an imaginary plaintiff, and of Richard Roe, an imaginary defendant, were familiar in cases of this kind in the English courts until 1852, when the Common Law Procedure Act abolished these fictitious suitors.

Ejector, in mechanical engineering, an appliance for ejecting gases, vapours, or liquids from closed spaces by the use of another gas, vapour, or liquid at a higher pressure. For instance, the air may be extracted from a condenser by an ejector. A jet of steam is directed along a short specially-shaped pipe leading from the condenser to the outside atmosphere. The

velocity of the steam when it leaves the jet in the pipe is very high, and it blows out into the atmosphere in spite of the atmospheric pressure against it. In blowing out into the atmosphere it sucks the air in the condenser along with it, and after it has been in operation some time practically the whole of the air is sucked out of the condenser. The appliance works on the principle of momentum. The active jet mixes with the material to be ejected and imparts a common momentum to the mixture, which is sufficient to enable it to pass outside the vessel from which the ejection is taking place. The same principle is used in the mercury air-pump (see *Air-pump*).—BIBLIOGRAPHY: W. E. Dalby, *Steam Power; Modern Mechanical Engineering* (The Gresham Publishing Company).

Ekat'erinburg, a town, Russia, in the government and 170 miles S.E. of Perm, founded in 1723 by Peter the Great. It is the mining and metallurgy centre of the Ural regions; and gem-cutting, the making of machinery, cloth, and candles are industries. Pop. 70,000.

Ekat'erinodar, a town of Russia in the Caucasus, chief town of the Kuban territory, on the River Kuban, a poorly-built place with a considerable trade. Pop. 107,360.

Ekat'erinoslav, a town of the Ukraine, capital of a government of the same name, on the right bank of the Dnieper, 250 miles N.E. of Odessa. Founded in 1787, it is a manufacturing centre, producing iron, machinery, tobacco, and beer. Pop. 220,100.—The government, which is intersected by the Dnieper and reaches the Sea of Azov, has great mineral wealth, especially in coal (Donetz basin), iron, manganese, and rock-salt; and its fertile black-earth soil produces abundant crops of wheat and other grains. Area, 24,478 sq. miles; pop. 3,537,300.

Elæagnæceæ, the oleaster family of plants, a small nat. ord. of apetalous dicotyledons scattered over the northern regions. The only British member is the sea-buckthorn (*Hippophaë rhamnoides*).

Ela'in, the oily principle of fat obtained by submitting fat to the action of boiling alcohol, allowing the stearin to crystallize, and then evaporating the alcoholic solution. It is not unlike vegetable oil in its appearance and its properties, and forms soaps with alkalis.

E'lam, the ancient name of a country on the eastern border of Babylonia. Its civilization dates back beyond 3000 B.C. Before 2000 B.C. it was strong enough to subdue part of Babylonia. Its power was finally broken by the last Assyrian monarchs. The capital was Susa, which became prominent again after the rise of Cyrus. Its splendour during the Persian period is reflected in the *Book of Esther*, in which it is referred to as 'Shushan'.

**Eland**, *Oreos (Orias) canna*, a species of antelope inhabiting Africa, the largest of all its kind, being about the size of an ox. Its flesh, especially that of the thighs, which are dried and used in this state, is highly prized. It is now almost extinct south of the Limpopo, but it is plentiful in the Kalahari. The colour is a light or greyish brown, and it possesses a short mane. The horns, which are about 18 inches long and nearly straight, are spirally keeled.

**Elanus**, the name of certain species of rap-torial birds of the genus *Elanus*, belonging to the kites. The type species is the black-winged kite (*E. caerules*) of Africa and South Asia,



Eland (*Oreos canna*)

which strays to South-West Europe. A very similar form (*E. leucurus*) is native to tropical and subtropical America, and other species (*E. scriptus* and *E. axillaris*) are Australian.

**Elaphomyces**, a genus of Ascomycetes fungi, section Plectascineæ, with closed, subterranean ascus-fruits resembling those of the genuine truffles (*Tuberineæ*), but not closely allied to that family. *E. cervinus* (Hart's truffle) is not infrequent in Britain; it forms 'mycorrhiza' with roots of oak, beech, and various conifers.

**E'laps**, a genus of poisonous American snakes, the type of the family Elapidae, to which belongs the cobra de capello.

**El-Arish**, Egyptian city on the Mediterranean, on the Wadi el-Arish, and chief city of the territory bearing the same name. It was taken by the French under Kléber in 1799, but abandoned the same year. Pop. about 5000.

**Elaamobranchii** (-brang'ki-i), a sub-class of fishes, including sharks, dog-fishes, rays (skates); and also *Chimæra* (q.v.) and its allies. They

are predaceous forms, in which the mouth is a transverse slit on the under side of the head, the numerous simple teeth are in several rows (except in chimæroids), the short intestine possesses a spiral valve and opens into a cloaca. The tail is asymmetrical (heterocercal), and numerous placoid scales (dermal denticles) are embedded in the skin. The skeleton is cartilaginous; the heart possesses a muscular conus arteriosus with numerous rows of pocket-valves; and there are five (sometimes six or seven) pairs of gill-pouches opening by slits to the exterior, these not being covered by an external flap (operculum) except in chimæroids. Fertilization is internal, and the male is provided with a pair of copulatory organs (claspers) projecting backwards from the pelvic fins. The eggs sometimes develop within the body of the mother, but are usually laid in horny pouches (mermaids' purses). The group is of great antiquity, and many extinct fossil types are known.

**Elasmothe'rium**, an extinct genus of Mammalia, found in the post-Pliocene strata of Europe, comprising animals of great size allied to the rhinoceros, and having probably one large horn and a smaller nasal horn.

**Elastic Bitumen**, **Elaterite**, or **Mineral Caoutchouc**, an elastic mineral bitumen of a blackish-brown colour, and subtranslucent. It has been found at Castleton, in Derbyshire.

**Elasticity**, the property in virtue of which bodies resist change of volume or of shape, and tend to regain their original bulk or shape when the deforming forces are removed. Solids possess elasticity of volume and of shape. Liquids and gases have elasticity of volume; they resist compression, but offer only a transient resistance to change of shape (see *Viscosity*). The elasticity of a gas is measured by the pressure to which the gas is subjected, if there is no change of temperature. When a gas is compressed suddenly, it has a greater elasticity on account of the rise of temperature which takes place. Liquids are less compressible than gases; water is compressed by about 1 part in 20,000 when the pressure on it is increased by one atmosphere. A knowledge of the elastic properties of solids is of importance in all branches of applied mechanics. Homogeneous solids offer definite resistance to compression, twisting, stretching, and bending, and this resistance is expressed by a number called a modulus. Let the deforming force be reckoned per unit of area, e.g. a pressure in tons per square inch; this is called the stress. The unital deformation produced by the stress is called the strain, for example, compression per unit of volume. The modulus is obtained by dividing the stress by the strain; if this is done with the above example, the ratio will give the bulk modulus. When the applied forces



cause change of shape without change of volume, the ratio of stress to strain is called the shape modulus or the rigidity of the material. This property is brought into play when mechanical power is transmitted by means of shafting. Young's modulus is employed in the cases of stretching and bending. It is given by the ratio stretching force per unit area to stretch per unit length. In 1678 Hooke stated the law that stress is proportional to the strain which it causes. This law is found in practice to be true for metals within a certain range of stress which lies below the elastic limit. If the stress is increased beyond this limit, the material begins to give way, and permanent change of shape or volume takes place. In the processes of riveting and wire-drawing, the material is purposely strained beyond the elastic limit, whilst the correct working of a spring balance requires that the spring should never be overstrained. When metals are subjected to frequently repeated stresses, they undergo a weakening and are said to become fatigued, and are liable to give way under a smaller stress than would otherwise cause fracture. The speed with which sound waves are transmitted through a material depends on the elasticity of the material; such compressional waves in water have been employed by the Roumanian engineer, Constantinesco, to transmit power by means of water-pipes.

**Mathematical Theory.**—Consider an elastic body at rest and free from strain. Let the body be subjected to forces, fulfilling the ordinary statical conditions of equilibrium, and therefore not tending to give the body any motion of translation or rotation as a whole. The particles of the body will move very slightly relative to each other; in other words, a system of strain will be set up in the body. To maintain this strain a definite system of stress is necessary. The problem for the mathematical theory is to determine the state of strain and stress at every point of the body when the applied forces are given. These applied forces may either be body forces (of which practically the only example is weight), or surface forces; the latter are pressures or tractions, and are defined by their directions and amounts per unit area. It is first of all necessary to show how strain and stress can be specified mathematically.

**Strains.**—If  $x, y, z$  are the co-ordinates of a point in the unstrained body, and if this point is displaced to  $(x + u, y + v, z + w)$  when the straining forces are applied, then  $u, v, w$ , which are supposed to be very small, are called the component displacements at  $(x, y, z)$ . It is clear that if  $u, v, w$  were constant, the body would simply be displaced without strain. The state of strain can in fact be shown to depend on

the first derivatives of  $u, v, w$  with respect to  $x, y, z$ . The strain round any given point consists simply of three stretches parallel to a certain set of three mutually perpendicular directions. These directions vary from point to point, so that this specification of the strain is inconvenient for calculations. A suitable method depends on the fact that the strain is known round a point when we know the values of the six quantities

$$\frac{du}{dx}, \frac{dv}{dy}, \frac{dw}{dz}, \frac{dv}{dx} + \frac{du}{dy}, \frac{dw}{dx} + \frac{du}{dz}, \frac{dw}{dy} + \frac{dv}{dz},$$

at the point. These are called the components of strain at  $(x, y, z)$ . The first three are *stretches* parallel to the axes, the other three are *shearing strains*. We may get an idea of the nature of these strains from two simple typical cases.

1. Let  $u = cx, v = 0, w = 0$ . This makes  $\frac{du}{dx} = c$ , and the other five strains zero. But

we see that the displacement of every particle is perpendicular to the  $yz$  plane, and proportional to its distance from that plane. Every line parallel to the axis of  $x$  is therefore elongated by a definite fraction of its original length, the value of this fraction being  $c$ , which is  $\frac{du}{dx}$ .

The strains  $\frac{du}{dx}, \frac{dv}{dy}, \frac{dw}{dz}$  are therefore *stretches* parallel to the axes. 2. Let  $u = 0, v = cz, w = 0$ . This gives  $\frac{dv}{dz} + \frac{du}{dy} = c$ , and the other

five strains zero. The displacement of every particle is parallel to the axis of  $y$ , and proportional to its distance from the plane  $xy$ . The strain is therefore a slide, or *shear* of planes parallel to  $xy$  in the direction of the axis of  $y$ .

**Stresses.**—To specify the stress round a point  $(x, y, z)$ , consider a small plane area through the point. The material on one side of this acts on the material on the other side with a certain force whose components parallel to the axes are  $F, G, H$ , say, per unit area. If we know  $F, G, H$  for every orientation of the small plane area, the state of stress round  $(x, y, z)$  is defined. But it is easy to show, as below, that we can find  $F, G, H$  for every area if we know them for areas parallel to the co-ordinate planes. We are thus led to the specification of the stress round  $(x, y, z)$  by the six *components of stress*,  $xx, yy, zz, xy, xz, yz$ ; where  $xy$ , for example, means the force per unit area *parallel* to  $Ox$  exerted on a plane *perpendicular* to  $Oy$  by the material on the positive side of that plane on the material on its negative side. Thus e.g. the components of the force per unit area exerted across the  $yz$  plane through  $(x, y, z)$  by the

material on the positive side of that plane are  $\bar{x}\bar{x}$ ,  $\bar{x}\bar{y}$ ,  $\bar{x}\bar{z}$ . It is important to note that  $\bar{x}\bar{y} = \bar{y}\bar{x}$ . This is easily proved by considering the equilibrium of a small rectangular volume of the material round  $(x, y, z)$  as centre, with its edges parallel to the axes; if  $\bar{x}\bar{y}$  were not equal to  $\bar{y}\bar{x}$ , there would be a residual couple in the plane  $xy$ .

*Relations between the Strains and the Stresses.*

—When the strains are known, the stresses can be found from a generalized Hooke's law, which can be deduced from the principle of energy, combined with consideration of symmetry. If the solid is isotropic, i.e. is symmetrical in its elastic properties in all directions round a point, the relations between stress and strain are of the form

$$\bar{x}\bar{x} = \lambda \left( \frac{du}{dx} + \frac{dv}{dy} + \frac{dw}{dz} \right) + 2\mu \frac{du}{dx}$$

$$\bar{y}\bar{y} = \mu \left( \frac{dv}{dy} + \frac{dw}{dz} \right);$$

the values of the other four components of strain can be written down from symmetry. Here  $\lambda$  and  $\mu$  are constants, each being a *modulus of elasticity*. In particular  $\mu$  is the *shape modulus* or the *rigidity*, already referred to. The Young's modulus and the bulk modulus can easily be found in terms of  $\lambda$  and  $\mu$ .

*Equations of Equilibrium in Terms of the Stresses.*—A rectangular element  $dx, dy, dz$ , of the body is held in equilibrium by the body force, and the tractions on its faces arising from the stress. The tractions per unit area, parallel to the axis of  $x$ , on the six faces, are: on the plane  $x$ ,  $-\bar{x}\bar{x}$ ; on the plane  $x + dx$ ,  $\bar{x}\bar{x} + \left( \frac{d}{dx} \bar{x}\bar{x} \right) dx$ ; on the plane  $y$ ,  $-\bar{x}\bar{y}$ ; on the plane  $y + dy$ ,  $\bar{x}\bar{y} + \left( \frac{d}{dy} \bar{x}\bar{y} \right) dy$ ; and similarly for the plane  $z$ . Let the force acting on the mass of the body, such as its weight, be  $(X, Y, Z)$  per unit mass, and let  $\rho$  be the density. By equating the sum of the  $x$  components of all the forces to zero, we get

$$\frac{d\bar{x}\bar{x}}{dx} + \frac{d\bar{x}\bar{y}}{dy} + \frac{d\bar{x}\bar{z}}{dz} + \rho X = 0;$$

Similarly

$$\frac{d\bar{x}\bar{y}}{dx} + \frac{d\bar{y}\bar{y}}{dy} + \frac{d\bar{y}\bar{z}}{dz} + \rho Y = 0,$$

and

$$\frac{d\bar{x}\bar{z}}{dx} + \frac{d\bar{y}\bar{z}}{dy} + \frac{d\bar{z}\bar{z}}{dz} + \rho Z = 0.$$

*The Surface Traction in Terms of the Stresses.*

—Draw a small tetrahedron round  $(x, y, z)$  with its faces perpendicular to the axes and to the

direction  $(l, m, n)$ , and consider the equilibrium of this small body. Let  $F, G, H$  be the components per unit area of the force on the plane whose direction cosines, *drawn outwards*, are  $l, m, n$ . If  $A$  be the area of the face perpendicular to  $(l, m, n)$ , we get, by resolving parallel to  $Ox$ ,

$$F \cdot A = \bar{x}\bar{x} \cdot lA + \bar{x}\bar{y} \cdot mA + \bar{x}\bar{z} \cdot nA.$$

$$\text{Hence } F = l\bar{x}\bar{x} + m\bar{x}\bar{y} + n\bar{x}\bar{z},$$

$$\text{and similarly } G = l\bar{x}\bar{y} + m\bar{y}\bar{y} + n\bar{y}\bar{z},$$

$$H = l\bar{x}\bar{z} + m\bar{y}\bar{z} + n\bar{z}\bar{z}.$$

If  $(x, y, z)$  is a point at the surface of the body, and  $l, m, n$  are the direction cosines of the outward normal at that point, these values of  $F, G, H$  are the component of the force that must be applied from outside to the surface at  $(x, y, z)$  to maintain the state of stress.

*The Equations connecting the Displacements and the Applied Forces.*—By using, in the equations of equilibrium, the values of the stresses in terms of the strains, we find the body equations of equilibrium in terms of displacements,

$$\mu \left( \frac{d^2u}{dx^2} + \frac{d^2u}{dy^2} + \frac{d^2u}{dz^2} \right) + (\lambda + \mu) \frac{d}{dx} \left( \frac{du}{dx} + \frac{dv}{dy} + \frac{dw}{dz} \right) + X\rho = 0,$$

with two similar equations.

The surface equations of equilibrium can also be written down at once by substituting the values of stresses in terms of strains in the expressions for  $F, G, H$  given above.

*The Problem of Equilibrium.*—To find the strain under given forces we have to solve the body and surface equations of equilibrium, when  $X, Y, Z$  and  $F, G, H$  are given. This problem has not been completely solved except in a few cases. It was solved by Lamé and Lord Kelvin for a solid or hollow sphere; it has also been solved for an infinite solid bounded by two parallel planes, or by a circular cylinder. Many particular solutions, however, are known for bodies of other shapes. Some of these solutions are of great practical value, e.g. St. Venant's solutions for the torsion and flexure of prisms. For bodies in which one or two dimensions are small, i.e. for thin plates and shells, and for thin rods, approximate theories have been given, which are partly deduced from the above exact equations, and partly from plausible hypotheses, a complete treatment based on the exact equations being in most cases impracticable.

*The Problem of Vibrations.*—When a body is vibrating, the mass acceleration parallel to  $Ox$  of the particle at  $(x, y, z)$  is  $\rho \frac{d^2u}{dt^2} dx dy dz$ . The equations of vibration are therefore found

by writing  $-\frac{d^2u}{dy^2}$  instead of X, in the first body equation of equilibrium, and similarly with the others. The surface conditions will usually be that F, G, H are zero. The problem has been completely solved by H. Lamb for a solid or hollow sphere. For the elastic solid theory of the luminiferous ether, see *Ether*; for some practical solutions of the general equations of equilibrium, see *Strength of Materials*.—BIBLIOGRAPHY: A. E. H. Love, *Mathematical Theory of Elasticity*; Lord Kelvin and Tait, *Natural Philosophy*; Todhunter and Pearson, *History of Elasticity and Strength of Materials*.

**El'ateridæ**, the name of a family of beetles, remarkable for their ability to throw themselves to a considerable height in the air, when placed on their back, by a vigorous muscular movement. Hence their names of springing-beetles, click-beetles, skip-jacks, &c. When alarmed, the elater counterfeits death. Flowers, grass, and decaying wood are the habitations of these animals, which are almost always found singly. The larvæ are often very injurious to vegetation, especially those which devour the roots of herbaceous plants (as in the genus *Agriotes*), and are known from their slenderness and hardness as wire-worms. The fireflies of America belong to the family. In these a pair of luminous organs is found on the thorax, while there is a third on the under side of the base of the abdomen. The *Pyrophorus noctilucus*, called *cucujos* in Brazil, is used as a personal ornament by ladies. The largest species of the genus *Elater*, the *Elater fabellicornis*, is  $2\frac{1}{4}$  inches in length.

**Elate'rium**, a substance obtained from the fruit of the squirting or wild cucumber (*Erbalium agreste*). The juice of the unripe fruit, when expressed and allowed to stand, deposits elaterium as a green sediment with an acrid taste, a faint odour, and powerful cathartic properties. It is a violent purgative, and is poisonous, but its action is not constant. The active principle in it is called *elaterin*.

**Elba** (Lat. *Itha*), a small island in the Mediterranean, in the province of Livorno (Leghorn), Italy, separated from the mainland by the Strait of Piombino, about 6 miles wide. The island is 18 miles long and from  $2\frac{1}{4}$  to  $10\frac{1}{4}$  miles broad, and is traversed by mountains rising to a height of over 3000 feet. It is rich in iron, marble, granite, salt, &c.; and iron ore is exported. Excellent wine and fruits are produced. It has two seaports—Porto-Ferrajo (the capital) and Porto-Longone. The Treaty of Paris in 1814 erected Elba into a sovereignty for Napoleon, who resided in it from 4th May, 1814, to 20th Feb., 1815, when he escaped and landed at Cannes on 1st March. After Napoleon's departure the

island was restored to Tuscany, which became part of Italy in 1860. Pop. 30,450.

**Elbe** (elb; Ger., pronounced el'be; Lat. *Albis*; Bohem. *Labe*), an important river in Central Europe. It rises on the south-west slopes of the Schneekoppe or Snowcap, one of the Riesengebirge, between Bohemia and Silesia. From this point it flows nearly due south into Bohemia for about 50 miles, when it turns to the west, and after about 40 miles takes a general north-north-west direction till it falls into the North Sea, intersecting Saxony and a considerable portion of Prussia. The finest scenery of its valley is in the Saxon Switzerland. Its length is 725 miles; drainage area, 56,865 sq. miles. The principal affluents are: on the right, the Iser, Schwarz-Elster, and Havel; on the left, the Alder, Moldau, Eger, Mulde, and Saale. In the lower part of its course the river divides into several arms, which unite again about 5 miles below Hamburg. It is more or less navigable for about 525 miles, but its estuary is much encumbered with sand-banks. In 1870 its navigation was declared free from Hamburg to Mecklenburg in Bohemia. The North Sea and Baltic ship canal connects its estuary with Kiel Bay, and there are other important connected canals. It is well stocked with fish.

**Elberfeld** (el'ber-felt), a town of Rhenish Prussia, in the government of and 15 miles east of Düsseldorf, on both sides of the Wupper, enclosed by lofty hills. Taken with Barmen it stretches along the Wupper valley for about 7 miles. The old streets are narrow and irregular, but the newer quarters are well built. It is a great seat of manufacturing industry, among its leading products being cottons, woollens, silks, velvet, mixed textile goods, buttons, ribbons, lace, yarns, thread, carpets, aniline dyes, iron and steel machinery, pianofortes, and paper. Calico-printing, dyeing, and bleaching are very extensively carried on. It has given its name to a system of poor relief, combining organized voluntary effort and individual treatment. Pop. 170,195.

**Elbeuf** (el-beuf), a town of France, department of Seine-Inférieure, 11 miles s.s.w. of Rouen, in a valley on the left bank of the Seine, connected by two bridges with St. Aubin on the opposite side of the river. It is an important centre for the production of woollen manufactures, chiefly of lighter cloths and fancy goods, and is also an entrepôt for the finer and heavier cloths of Louviers and Sedan. It communicates by steamers with Paris, Rouen, and Havre. Pop. 19,240.

**Elbing**, a seaport town of East Prussia, on the Elbing, near its entrance into the Frische-Haff. It was once a flourishing Hanse town, and is still a place of considerable industry and

trade, the manufactures including iron goods, machinery, brass and tinplate goods. It has also shipbuilding yards. Pop. 58,636.

Elburz, a lofty mountain range extending over Northern Persia, parallel with and overlooking the Caspian. Highest peak, Mt. Demavend, 19,400 feet; average height, 6000 to 8000 feet.

Elcesaites (el-ses'a-its), a sect of Gnostics which arose in the reign of Trajan about the beginning of the second century. They were a

Elder, a name given to different species of the genus *Sambucus*, nat. ord. Caprifoliaceæ. These are small trees or shrubs, with opposite and pinnated leaves, bearing small white flowers in large and conspicuous corymbs, small berries of a black or red colour, and bitter and nauseous leaves possessing purgative and emetic properties. The wood of the young shoots contains a very large proportion of pith. The common elder of Britain (*S. nigra*) is a wild shrub or small tree, distinguishable by its winged

leaves, its clusters of small, cream-white flowers, and the small black berries by which these are succeeded, and from which a kind of wine is sometimes made. The dwarf elder or danewort (*S. Ebulus*) is also found in many parts of Britain, and was popularly supposed to have sprung from the blood of the Danes. Two species inhabit North America: *S. canadensis*, a common plant from the 40th to the 30th parallel of latitude, the berries of which are black and have a sweet taste; and *S. pubescens*, which bears red berries, and inhabits Canada, the northern parts of New England, and the Alleghany Mountains. Elder wood is yellow, and in old trees becomes so hard that it is often substituted for box-wood. Its toughness, also, is such that it is made into skewers and tops for fishing-rods. The light pith is utilized for hells



Common Elder: Foliage, Inflorescence, and Fruit

branch of the Essenes, and resembled the Ebionites. A Jew, named Elxai, or Elkesai, is their reputed founder.

Elche (el'châ), a town of Spain, in the province and 14 miles w.s.w. of Alicante, on the left bank of the Vinalopo, surrounded by palm trees. It contains various Roman remains, a fine church, and a town house of the fifteenth century. Chief industry, the culture of dates. Each summer, from the 13th to the 15th of August, an interesting fête is held at Elche, and a fourteenth century liturgical drama (*The Representation of the Assumption of Our Lady St. Mary*) is performed. Pop. 27,620.

Elchingen (el'hing-en), Ober and Unter, two villages of Bavaria, on the left bank of the Danube, about 3 miles apart and 8 miles north-east of Ulm. In 1805 Marshal Ney defeated the Austrians at Ober Elchingen, and won for himself the title of Duke of Elchingen.

for electric experiments, and various ointments, drinks, and medicinal decoctions are made from the bark, leaves, flowers, and berries.

Elders, persons who, on account of their age, experience, and wisdom, are selected for office, as, among the Jews, the seventy men associated with Moses in the government of the people. In the modern Presbyterian Churches elders are officers who, with the pastors or ministers, compose the consistories or kirk-sessions, with authority to inspect and regulate matters of religion and discipline in the congregation. As a member of the kirk-session the elder has an equal vote with his minister, and as a member of the higher Church courts, when delegated thereto, he has a right to discuss and vote on all matters under discussion in the same manner as the clergy themselves. In the Mormon Church the elder is an officer whose duty it is "to preach and baptize, to ordain other elders, to bless children,

and to take the lead at all meetings". Among the Shakers there are four elders, two men and two women, in each congregation.

Eldon, John Scott, Earl of, Lord Chancellor of England, born in 1751 at Newcastle-on-Tyne, died in London, 18th Jan., 1838. His father was a coal-dealer and public-house keeper of means, and John was educated with his brother William (afterwards Lord Stowell) at Newcastle, and at Oxford, where he obtained a fellowship. He was called to the Bar in 1776, and in 1782 was made King's Counsel. Next year he entered Parliament, supported Pitt, and was made Solicitor-General, and knighted. In 1792 he purchased the estate of Eldon. In 1793 he became Attorney-General, and in 1799 was created Chief Justice of the Court of Common Pleas, and raised to the peerage and the House of Lords by the title of Baron Eldon. On the accession of the Addington ministry he became Lord Chancellor (1801), and retained this post under the subsequent administration of Pitt until the death of the latter in 1806. A year later, however, he resumed the chancellorship under Liverpool, and held it without break for twenty years. In 1821 he was created an earl by George IV. On the accession of the Canning ministry in 1827 he resigned the chancellorship, and never again held office. As a lawyer he was a master of English jurisprudence; as a politician he was opposed to reform, and by no means free from the charge of servility and intrigue.

El Dora'do, a country that Orellana, the lieutenant of Pizarro, pretended he had discovered in South America, between the Orinoco and Amazon Rivers; and which he named thus on account of the immense quantities of gold and precious metals which, he asserted, he had seen in Manoa, the capital of the country. The term El Dorado was first applied to a South American tribal king who was said to cover his body annually with gold-dust. It now designates any place abounding in gold, or offering opportunities for the acquisition of sudden wealth.

Eleanor Crosses (el'i-nor), memorial crosses erected on the spots where the bier of Eleanor, the wife of Edward I, rested on its way from Grantham to Westminster. Twelve were erected, but only three, those of Northampton, Geddington, and Waltham, remain.

Eleat'ic School, a Grecian philosophical sect, so called because it originated in Elea (Lat. *Velia*), a town of Magna Græcia (Southern Italy), of which also three of its most celebrated teachers, Parmenides, Zeno, and Leucippus, were natives. The founder was Xenophanes of Colophon, who came to Elea late in life, bringing with him the physical theories of the Ionian school, to which he added a metaphysic. The two schools soon drifted widely apart, especially in respect of

method. In opposition to the physical philosophy of the Ionian school, and also the doctrine of Heraclitus, who taught that everything is flux, the Eleatic philosophers asserted that change and difference are only empty illusions, and that the only true reality is changeless being. Starting from the observation of external nature, the Ionians endeavoured to discover some elementary principle, as water, air, fire, or a combination of elements, by the action of which the phenomena they observed might be accounted for. The Eleatics made the abstract idea of Being or God, deduced from the contemplation of the Universe as a whole, their starting-point. Their reasonings sometimes led them to deny the reality of external phenomena altogether.

Elecampane (el-i-kam-pān'; *Inula Helénium*), a plant of the nat. ord. Compositæ, found in Britain and other parts of Europe, and in Asia. It is 3 or 4 feet high; the radical leaves are often 2 feet and more in length; the flowers are large and yellow; the root, which is perennial, possesses a bitter camphor-like taste. It was formerly much used as a stimulant for all the secreting organs, and in tuberculosis on account of the germicidal action of the bitter principle (helenin) which it contains.

Election, in theology, the doctrine that God has from the beginning elected a portion of mankind to eternal life, passing by the remainder. It is founded on the literal sense of certain passages of Scripture, and has been amplified by the labours of systematic theologians into a complete and logical system. It dates in ecclesiastical history from the time of Augustine; but Calvin has stated it so strongly and clearly in his *Institutes* that it is generally associated with his name.

Election, in politics, the selection by voting of a person or persons to occupy some post or office. The most important elections are those of the members of the legislative assemblies of the different countries, and as to the manner in which these are carried out strict laws are in force. In such elections voting by ballot is now general. The chief forms of election in Britain are parliamentary and municipal elections, in both of which the basis of the suffrage (or right of voting) is the payment of poor rates. Members of Parliament formerly required a property qualification in England and Ireland; but this restriction, which never existed in Scotland, has been abolished. In both parliamentary and municipal elections the ballot has been in operation since 1872. For the prevention of bribery and corrupt practices many Acts have been passed, of which that now in operation came into force in Oct., 1883, and has been annually renewed. By it persons convicted of treating, bribery,

personation, and undue influence are liable to imprisonment with hard labour, and to disqualification in respect of the franchise and public offices. It also imposes many limitations with regard to the number of assistants and committee-rooms, and the use of conveyances. By the Reform Act of 1918, the maximum expenditure for campaign purposes during parliamentary elections is to be sevenpence per elector in county constituencies, and fivepence per elector in boroughs. By this Act the cost of registration is paid half out of local rates, and half by the State. At election times the returning officer's expenses are to be paid by the Treasury. Under the provisions of the Ballot Act the returning officer is required, in the case of a county election, to give notice of an election within two days after that on which he receives the writ; or in the case of a borough election, to give notice on the day on which he receives the writ, or at the latest on the day following. In county or district borough elections the nomination must take place within ten days of the receipt of the writ, at least three clear days, however, being allowed to elapse between the first public notice and the day of nomination. In ordinary borough elections the candidate must be nominated not earlier than the third day after public notice, and not later than the fourth day after that on which the writ is received. A candidate is nominated in writing, with the signatures of a proposer, seconder, and eight other electors, all registered in the constituency to be represented. In the event of there being more candidates than vacancies, the returning officer adjourns the election for the purpose of taking a poll. The polling must take place not less than two or more than six clear days after the day of nomination, if it be a county or district borough election; in the case of an ordinary borough, it must take place not more than three clear days after nomination, Sundays, Christmas Day, &c., not being counted as days. Where the votes for rival candidates are equal, the returning officer, if registered in the constituency, may give the casting-vote. If he declines to do so, a scrutiny is demanded, which usually results in certain deductions on the ground of spoiled papers, disqualified voters, &c., sufficient to give one candidate priority. In elections for the school boards the cumulative system of voting is employed (see *Cumulative Vote*).—Cf. C. Seymour and D. P. Frary, *How the World Votes*.

**Electoꝛ** (Ger. *Kurfürst*, 'electoral prince'), the title of certain princes of the Holy Roman Empire, who had the right of electing the emperors. In the reign of Conrad I, King of Germany (912-918), the dukes and counts became gradually independent of the sovereign, and assumed the right of choosing future monarchs.

In the thirteenth century the number of these electors was seven—the Archbishops of Mainz, Cologne, and Trèves, the King of Bohemia, the Count Palatine, the Duke of Saxony, and the Margrave of Brandenburg. In 1648 an eighth electorate was created to make room for Bavaria, and Hanover was added as a ninth in 1692. The votes of the Palatinate and of Bavaria were merged in one in 1777. In 1802 the two ecclesiastical electors of Cologne and Trèves were set aside, and Baden, Württemberg, Hesse-Cassel, and Salzburg declared electorates; so that there were ten electors in 1800 when the old German Empire was dissolved.—Cf. Viscount Bryce, *The Holy Roman Empire*.

**Electrical Fishes**, a name given to fishes possessing the property of communicating an electric shock when touched with the hand or any electric conductor. One of the best known is the electric eel (*Gymnotus electricus*), a native of South America. It is of nearly equal thickness throughout; head and tail obtuse; ordinary length, 3½ to 4 feet. The seat of the four electrical organs is along the under side of the tail, and they are said to possess the power of knocking down a man, and of painfully numbing the affected limb for several hours after the shock. After a few discharges, however, the faculty of producing a shock is impaired, and an interval of rest is required for a new storage of force. Similar but less-marked powers are possessed by an African cut-fish (*Malapterurus electricus*), in which the electric organ invests the entire body as a sort of jacket under the skin. Still feebler in this respect are the electric rays, of which the best known (species of *Torpedo*) are native to the Mediterranean, Red Sea, Atlantic, and Pacific Oceans. Here the electric organ consists of a large mass on each side of the front part of the body.

**Electrical Measuring Instruments**, the name given to instruments which measure electric power, energy, voltage, or current. The majority of such instruments are current-operated. Thus, with the exception of electrostatic voltmeters, all voltmeters are really current measuring instruments; but since this current is made to be proportional to the P.D. between the voltmeter terminals, the scale reading is proportional to the voltage being measured. One and the same instrument may be used as an ammeter or as a voltmeter, by providing it with shunts for use as an ammeter, and series resistances for use as a voltmeter. If the current to be measured is large, the *shunt* will have a very low resistance compared with that of the instrument, so that only a small fraction of the total current passes through the instrument. Similarly, when a large P.D. is being measured, the *series resistance* will have a very high value, so that the current

through the instrument may not exceed that which gives full-scale reading. By using shunts or series resistances of different values, different ranges can be given to the instruments.

In addition to the types already described (see *Ammeter*), there is a class depending on the mutual action of current-carrying conductors placed near one another. This type is largely used in alternating-current work. It is also specially suitable for power measurements, and practically all *wattmeters* work on this principle. The Siemens Dynamometer was the first instrument of this type.

The Kelvin Standard Balance is a special form of dynamometer, in which the mechanical turning-moment due to weights on a beam is balanced by the electrical turning-moment due to currents in fixed coils and in coils attached to the ends of the beam. The electrostatic voltmeter mentioned above is the only instrument which is operated by a P.D. instead of a current. In it a moving vane is attracted into a fixed pair of quadrants; or a set of vanes is attracted into a set of quadrant cells.

The majority of electricity meters are of the motor type, i.e. a disc is driven by motor action at a speed which is proportional to the power passing through the meter. The disc spindle engages with gearing which drives the pointers on a set of dials recording the energy units. There are also meters depending on electrolytic action (Wright meter); or on the difference in period between two pendulums, one of which is controlled by the load current (Aron meter).

**Electric Battery**, a group of primary or secondary cells, suitably arranged for the purpose of producing an electric current. Primary batteries consisting of a few cells are commonly used for intermittent work where a relatively small current is required, e.g. for electric bells. If a larger current is necessary, especially if it has to be maintained over a considerable period, a battery of secondary cells is used. Such batteries are commonly used for country house lighting. Very large batteries, used either alone or in conjunction with automatic reversible boosters, are frequently employed in public electric supply systems.

The name *electric battery* was originally given to an arrangement of Leyden jars (see *Leyden Jar*), but is now applied only to cells, the Leyden-jar arrangement being called a Leyden-jar battery.

**Electricity**, the name given to the ultimate cause of electrical phenomena. The laws governing these phenomena are well known, but the actual nature of electricity has not yet been fully revealed, although much light has been thrown on the subject by recent researches. (See *Electron*.) Although the practical applications

of electrical phenomena have all been developed within the last fifty years, the production of an electric charge by friction, as demonstrated by the power of rubbed amber to attract light bodies, was observed by a Greek philosopher as long ago as 600 B.C. The Greek name for amber, *ηλεκτρον* (electron), is the root from which our word electricity is derived. Friction was the only artificial source of electricity known until Galvani, near the close of the eighteenth century, accidentally obtained it by the contact of two metals with the limbs of a frog; and Volta, developing Galvani's discovery, invented the first galvanic or voltaic battery.

The discovery by Faraday in 1831 of the principle of the production of an electromotive force by the motion of a conductor in a magnetic field, laid the foundation for the development of the electric generator (q.v.), and thus of modern electric power supply.

The study of electrical phenomena is conveniently divided into two branches, one dealing with stationary charges of electricity (*electrostatics*), the other with electric currents (*current electricity*).

**Electrostatics.**—If a pair of ebonite rods be electrified by friction with flannel, then by suspending the one rod and presenting the other to it, it is easily demonstrated that a mutual mechanical force of repulsion exists between them. If now a glass rod be electrified by friction with silk, it will be found that it attracts the suspended electrified ebonite rod. These experiments reveal the facts that electric charges may be of two opposite kinds, and that like charges repel one another, while unlike charges attract one another.

The charge produced on glass by friction with silk is called *positive*; that produced on ebonite by friction with flannel is called *negative*. The kind of charge produced depends not merely on the material rubbed, but also on the material of the rubber. Thus a warm dry glass rod becomes *negatively* electrified when rubbed with fur. The rubber always becomes electrified with a charge of the *opposite* kind to that produced on the material rubbed, and these two charges are *equal in amount*. All bodies may be electrified by friction, but those which allow a free movement of the charge over them (such bodies are called *conductors*, to distinguish them from *insulators*, which do not allow this free movement) must be held by an insulating handle, or else the charge will be removed as quickly as it is produced.

Coulomb proved that the magnitude of the mutual mechanical force exerted between two charged bodies depends on the amounts of the charges and the distance between them. Faraday called attention to the influence of the medium



in which the charges are placed. Thus if two charges of  $q_1$  and  $q_2$  units respectively are placed  $d$  centimetres apart in a given medium, the mechanical force  $f$  in dynes exerted between them is given by the equation  $f = \frac{q_1 q_2}{Kd^2}$  provided the dimensions of the bodies on which the charges are concentrated are small in comparison with  $d$ . The coefficient  $K$  is called the *dielectric constant* of the medium, and its value is taken as unity for air.

In accordance with this relationship, *unit charge* is defined as that charge which repels an equal and similar charge placed at a distance of 1 centimetre in air, with a force of 1 dyne.

If the medium surrounding a charged body be explored with a unit charge, a mechanical force varying in magnitude and direction from point to point will be found to act on the unit charge. In such a case, an *electric field* is said to exist in the medium.

The *strength of the electric field* at any point is defined as numerically equal to the mechanical force which would act on a unit charge placed in air (or more strictly in a vacuum) at that point. The *direction* of the electric field at any point is defined to be the direction of the mechanical force acting on a unit *positive* charge placed at that point.

It should be noted that the strength of the electric field and the mechanical force are numerically equal only when the dielectric constant of the medium is unity. Thus if  $F$  is the field strength,  $K$  the dielectric constant, and  $U$  the mechanical force acting on a unit charge,  $F = KU$ .

It is very convenient to represent an electric field by means of what are called *lines of electric force*. If lines are drawn, starting from a positive charge and ending on a negative charge, such that the tangent to the line at any point is the direction of the electric force at that point, these lines are called lines of electric force. They can be drawn in such a way that the strength of the electric field at any point is numerically equal to the number of lines of electric force passing through unit area surrounding that point (and taken at right angles to the direction of the force). The lines of electric force will thus completely represent the electric field.

Further, if the following properties are attributed to the lines of electric force, viz. (a) that a line of electric force tends to shorten itself as far as possible; (b) that lines of electric force mutually repel one another; then all the phenomena due to the presence of an electric field may be interpreted by the behaviour of the lines of electric force.

Figs. 1 and 2 show the lines of electric force in

the space surrounding two charged spheres. Fig. 1 shows the case where the charges are opposite, fig. 2 the case where they are similar. In fig. 1 the attraction between the spheres may be thought of as due to the tendency of the lines of force to shorten themselves. Similarly, the mutual repulsion of the spheres in fig. 2 may be

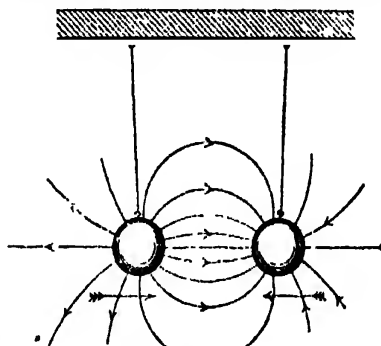


Fig. 1

regarded as a consequence of the mutual repulsion of the lines of force.

The distribution of a charge upon an insulated conductor isolated in space depends upon the shape of the conductor. If the conductor is spherical, the charge is uniformly distributed. If the curvature varies from point to point, the

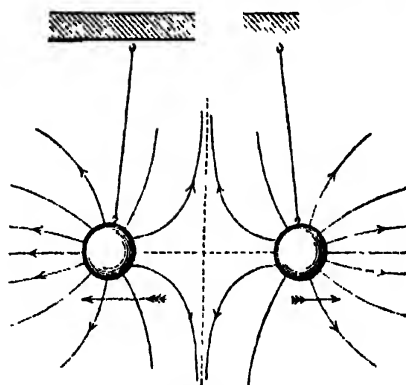


Fig. 2

quantity of charge per unit area, or the *electric surface density*, will vary from point to point. The sharper the curvature is, the greater the surface density will be. In fig. 3 the distance of the dotted lines from the surface of the conductors is proportional to the surface density. These lines, therefore, give a graphical representation of the distribution of charge. In sharply pointed conductors nearly the whole charge will be concentrated at the pointed end. Owing to

the large charge per unit area at the pointed part, particles of dust, water-vapour, &c., will be powerfully attracted, will become charged by conduction, and will then be powerfully repelled. In this way the original charge will be rapidly dissipated. This effect may be shown by keeping a sharply pointed conductor powerfully charged by an electric machine. The streaming of the particles from the point produces a wind which is sufficient to blow out the flame of a candle.

Conductors which are intended to retain their charge for a long period must be smooth and

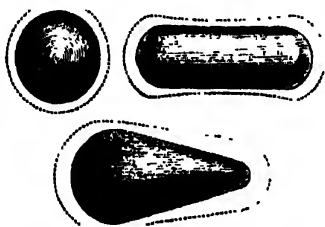


Fig. 3

polished, and the maximum curvature must be as small as possible. In lightning-conductors practical advantage is taken of this 'power of points' to dissipate a charge rapidly.

The distribution of the charge on a conductor is influenced by the presence of other conductors, whether charged or not. This is due to what is called *electrostatic induction*. If an uncharged insulated conductor B is brought near a charged conductor A, a charge of the *opposite* kind is induced on the parts of B nearer to A, and a charge of the *same* kind on the parts farther away from A. Since B was originally uncharged, these induced charges are equal in amount.

If B is now removed to a distance, the induced charges neutralize one another, and B returns to its original uncharged state.

While B is near A, let the induced charge of the *same* kind as the charge on A be neutralized by touching B with an earth-connected conductor, say the finger. On removing B to a distance, it will no longer be uncharged as before, but will have a charge of the *opposite* kind from that on A. B is now said to have been *charged by induction*.

It is instructive to view these phenomena in the light of the conception of lines of electric force. When B is brought up towards A, some of the lines of force associated with the charge on A, and originally linked to surrounding objects, will now, owing to the tendency of the lines to shorten themselves, be linked to B. At the same time an equal number of lines (of opposite direction relative to B) will link B to the nearest surrounding objects.

Since by definition a line of force starts from a positive charge and ends on a negative charge, the charge on the parts of B nearer to A will be of the *opposite* kind to that on A, but the charge on the part farther from A will be of the *same* kind as that on A. When the earth-connected conductor is brought near B, the lines formerly linking B to surrounding objects will link B to the earth-connected conductor. Finally, when the latter touches B, these lines shorten themselves indefinitely and disappear.

The attraction of light particles to a charged body is explained by electrostatic induction. The charge of opposite kind induced on the particle being nearer than that of the same kind, the particle is attracted. When it touches the charged body, the charge of opposite kind is neutralized, and the charge of like kind now left on the particle causes repulsion to take place. If the electrified body is an insulator, the neutralization of the charges only takes place slowly, and consequently it may be some time before the particle is repelled.

If two charged conductors be connected by a wire, in general it will be found that a flow of electricity from one to the other will take place. This flow is said to be due to a *difference of electric potential* between the two conductors. If no flow takes place, then the difference of potential is zero. Electric potential difference (the contraction P.D. is commonly used) is numerically equal to the work done in carrying a unit charge

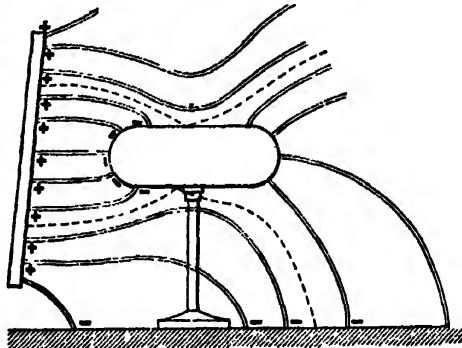


Fig. 4.—Induction, and Lines (or tubes) of Force

from the one conductor to the other. If the work is done *against* the electric forces, in moving a unit positive charge from A to B, then B is said to be at a higher potential than A. Although actually it is with *differences* of potential that we have always to deal, it is convenient in many cases to refer these differences to a zero, and speak of the *potential* at a point. The ideal zero of potential would be the potential at a point infinitely far removed from all electrified bodies. In practice it is convenient to regard the potential

of the earth as zero. The potential at a point is then numerically equal to the work done in carrying a unit positive charge from earth to the point. The potential at every point on a conductor is obviously the same, for if it were not so, a flow of charge would take place and equalize the potential. If an insulated uncharged conductor be connected by a wire to a charged conductor, a flow of charge will take place until every point on both conductors is at the same potential. The quantity of charge which each conductor will then have depends on what is called the *capacity* of the conductor.

The *capacity* of a conductor is defined as the quantity of electricity with which it must be charged in order to raise its potential from zero to unity. Thus if  $Q$  be the quantity,  $V$  the potential, and  $C$  the capacity, we have  $C = \frac{Q}{V}$ .

The potential of a conductor is, therefore, directly proportional to the charge upon the conductor, and inversely proportional to the capacity of the conductor.

The capacity of a conductor may be increased by placing close to it another conductor which is kept at zero potential. Such an arrangement is called a condenser. The Leyden jar (see *Leyden Jar*) is a well-known example of a condenser. The capacity depends not merely on the dimensions of the conductors and the distance between them, but also upon the nature of the dielectric separating them. The ratio of the capacity of a condenser with a given dielectric to the capacity it would have with an air dielectric, is called the *specific inductive capacity* of the dielectric. Numerically the specific inductive capacity of a dielectric is equal to the dielectric constant already mentioned.

In the experimental investigation of electrostatic phenomena it is convenient to have

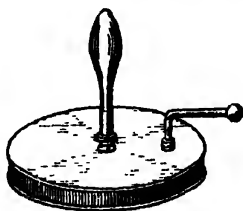


Fig. 5.—Electrophorus

appliances which will supply charges as they are required. The simplest appliance of this kind is the electrophorus, which consists of a disc of ebonite or other suitable material with a metallic base, and a metal disc of slightly smaller diameter having an insulating handle attached at right angles to its surface (see fig. 5). To use the electrophorus, the ebonite is given

a negative charge by striking it with fur or flannel. The metal disc is then placed on top of the ebonite plate. Since the ebonite is an insulator, no general neutralization of the positive induced charge on the lower side of the metal disc can take place. The negative charge on the upper surface of the metal disc is then neutralized by touching with the finger. The disc is thus left positively charged. The disc

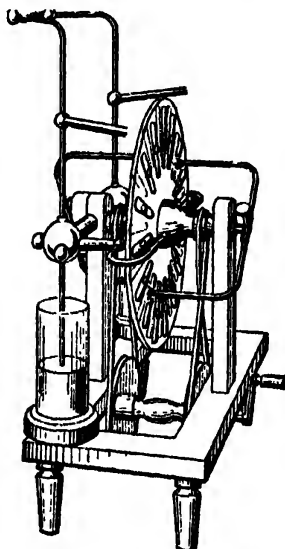


Fig. 6.—Wimshurst Machine

is then lifted by the insulating handle, and the charge utilized as required. Theoretically speaking, this process may be repeated continuously without affecting the original charge on the ebonite plate, but in practice the ebonite has to be re-excited from time to time on account of the loss of charge by leakage. More elaborate appliances of many different forms have been used, but the only one of these *electric machines*, as they are called, which is now commonly employed is the *Wimshurst machine*. This machine consists of two circular plates of glass or ebonite carrying equal even numbers of tin-foil sectors symmetrically placed on their outer surfaces. A pair of brass arms carrying wire brushes, which simultaneously make contact with diametrically opposite sectors on each plate, is so arranged as to lie at an angle of about  $45^\circ$  to the horizontal, and to be at right angles to one another. A pair of combs is placed at each end of the horizontal diameter of the plates, so that the sectors pass close to the teeth of these combs. The combs serve as collectors, and are connected one pair to the positive pole, and the other pair to the negative pole of the machine. The general appearance of the machine

is shown in fig. 6. The machine acts on the induction principle, and if kept warm and dry is self-exciting.

The *electroscope* is a simple piece of apparatus for detecting the presence of an electric charge, determining its sign (positive or negative), and making a very rough comparative estimate of its potential. It consists of a pair of strips of gold-leaf attached to a brass rod terminating in a brass cap. The whole is enclosed in a glass case, or a case having glass sides. The base is made of conducting material. The sides of the case are coated internally with tinfoil (or two rods connected to the base project upwards to the level of the gold-leaf strips). The general appearance of one form of electroscope is shown in fig. 7. The gold-leaf strips, the brass rod, and the cap must be carefully insulated. When a charged body is brought near the electroscope the leaves become charged similarly by induction. The repulsion due to the similar charges causes the leaves to diverge.

If the cap be touched with the finger, the charge on the leaves is neutralized, and the leaves collapse. On removing the charged body the leaves diverge again, owing to the spreading of the charge on the cap, which was held by the inducing charge, over the whole conductor, including the leaves. The electroscope is thus charged by induction. It may also be charged by conduction, i.e. by the direct transfer of a charge to the electroscope. When we know the kind of charge, positive or negative, which has been given to the electroscope, an unknown charge can be tested. If the approach of the unknown charge causes a further divergence of the leaves, then it is of the same kind as that with which the electroscope is charged.

When accurate quantitative measurements have to be made, an instrument called an *electrometer* is used. This instrument, the development of which is due chiefly to Lord Kelvin, is capable of making accurate measurements of electrostatic potential differences down to quite low values.

Essentially an electrometer consists of a light suspended conductor which moves within four fixed quadrants. Opposite pairs of these quadrants are connected together, one pair to one terminal, and the other pair to the other terminal of the instrument. The P.D. to be measured is applied at these terminals. The

suspended conductor or 'needle' is charged to a definite high potential, and the deflection produced is observed from the movement of a spot of light reflected from a mirror attached to the suspending fibre. In this case the deflection is proportional to the P.D. between the quadrants. For measuring a high P.D., the needle may be connected to one pair of quadrants. With such an arrangement the instrument is less sensitive, and the deflection is proportional to the square of the P.D. between the quadrants.

*Current Electricity.*—The phenomena connected with the flow of electricity through a conductor come under this heading. Such a flow of electricity will take place if by some means the ends of the conductor are maintained at different potentials. An *electric current* is then said to exist in the conductor. The difference of potential may be maintained by chemical action (see *Daniell's Cell*; *Electric Battery*), by electrodynamic action (see *Generator*), or by heat action (see *Thermo-electricity*). The magnitude of the current which will flow when a steady P.D. is maintained between the ends of the conductor is determined by what is called the electrical *resistance* of the conductor. The resistance  $R$  is defined as the ratio of the applied potential difference  $V$  to the current  $I$  produced, i.e.  $R = \frac{V}{I}$ . This is a partial expression of

Ohm's Law for the Electric Circuit, which in its most general form states that the current which flows at any instant in an electric circuit is equal to the algebraic sum of the electromotive forces existing in the circuit at that instant, divided by the total resistance in the circuit at that instant (see *Electromotive Force*).

For the particular case where the algebraic sum  $E$  of the electromotive forces is steady, and the total resistance  $R$  is not varying, we have  $I = \frac{E}{R}$ . This is the form which applies to steady

direct currents. If the current is changing (whether alternating or merely varying in value), varying E.M.F.'s, in addition to the applied E.M.F., exist in the circuit, and the above expression no longer holds good.

The resistance of a conductor depends on its material, and varies directly as the length, and inversely as the cross-section of the conductor.

Thus  $R = \rho \frac{l}{A}$ , where  $\rho$  is the specific resistance

of the material,  $l$  the length of the conductor, and  $A$  the cross-sectional area of the conductor. The *specific resistance* is the resistance between opposite faces of a unit cube of the material at a definite temperature (usually  $0^\circ \text{C.}$ ). The resistance of a conductor varies to a greater or less extent with variation of temperature.



Fig. 7.—Electroscope

For pure metals the resistance increases considerably with increase of temperature. With certain alloys the change is so slight as to be negligible. In some alloys, and in carbon and insulating materials, the resistance falls with increase of temperature.

*Measurement of Resistance.*—Low resistances can most conveniently be measured by a fall of potential method, based on the relationship

$$R = \frac{V}{I}.$$

The current may be read by an ammeter,

and the potential difference by a low-reading voltmeter (see *Electrical Measuring Instruments*). Where greater accuracy is required, a constant current is sent through the resistance to be measured, and also through a known standard resistance of about the same value. A sensitive galvanometer (see *Galvanometer*) is used to compare the P.D. across the unknown resistance with that across the standard. Since the current is the same through both, the resistances will be proportional to the galvanometer deflections, and from the known value of the standard resistance the value of the unknown resistance can be calculated. Resistances of moderate value are best measured by a Wheatstone Bridge, or one of its modifications (see *Wheatstone Bridge*).

A substitution method is more suitable for high resistances. A galvanometer is connected in series with a standard high resistance and a steady source of E.M.F. The deflection is noted. The unknown resistance is now substituted for the standard, and the new deflection noted. Provided the resistance of the galvanometer and other parts of the circuit is negligible in comparison with the resistance to be measured, the resistances are inversely as the deflections. The unknown resistance is, therefore, equal to the ratio of the first to the second deflection multiplied by the value of the standard resistance. For insulation tests on installations, direct-reading instruments are frequently used (see *Ohmmeter*).

*Effects of an Electric Current.*—When a current flows in a conductor, the temperature of the conductor is raised. This is due to the power dissipated on account of the resistance of the conductor. The power dissipated is equal to  $I^2R$  watts, and by giving suitable values to  $I$  and  $R$  any required amount of heat per second can be obtained. This *heating effect* of the current is made use of in electric lighting, electric heating and cooking, in electric furnaces, and in certain electro-medical appliances.

If a magnetic needle is brought near a conductor carrying a current, it will be found to be deflected. This is due to the magnetic field, which is always associated with an electric current. This *electro-magnetic effect* is of the utmost

practical importance (see *Electro-magnetism; Generator; Electric Motors*).

When a current is passed through a conducting liquid, such as a solution of a metallic salt or a salt in a fused state, chemical action takes place. The behaviour of such a conductor is entirely different from that of a metallic conductor, since a current can flow in it only if chemical dissociation takes place (see *Electrolysis*).

Practical use of electrolysis is made in electroplating, the production of electrolytic blocks for printing, the refining of copper, and the production of metallic sodium and potassium. Electrolysis is also used as a means of storing electrical energy in a chemical form (see *Secondary Cell*).

An electric current may be constant in direction (*direct current*), or may alternate in direction with a certain frequency (*alternating current*). Alternating currents have advantages for the transmission of large amounts of power over considerable distances (see *Electric Power Transmission and Distribution*), and may be used for electric lighting and the operation of electro-dynamic machines and apparatus (see *Electric Motors*).

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**Electric Light**, a light obtained by the conversion of electric energy into light energy. The usual method is to heat some material to incandescence by passing an electric current through it. The material may be carbon (arc lamps), tungsten wire (all modern incandescent lamps), mercury vapour (mercury vapour lamps), or volatilized metallic salts (flame arc lamps). Other materials have been used, such as zirconium, yttrium, and thorium oxides, and osmium and tantalum among the metals, but they have been displaced entirely by the materials mentioned above.

Ordinary arc lamps, and even flame arc lamps, are being displaced by the modern high-candle-power gas-filled tungsten lamp. Flame arc lamps have a high efficiency, and are still largely used for street lighting, but the cost of the frequent trimming required, even in lamps of the magazine type, gives the gas-filled lamp an advantage over them. Lamps of the mercury vapour class have a high efficiency, and the light has a high actinic value which is valuable for certain photographic processes, but the absence of the red and orange part of the spectrum gives the light a characteristically ghastly effect which limits the use of this type of lamp.

*The Carbon Arc.*—Although the arc lamp has fallen into disuse, the carbon arc is still extensively employed for projection work, as in cinema projectors and in searchlights. The action of the carbon arc is as follows: If a potential difference of about 50 volts is maintained between a pair of carbon rods, and the tips of the rods are momentarily brought into contact and then separated by a short distance, then the current is maintained by an arc across the gap. The temperature of the positive tip rises to about  $4000^{\circ}\text{C}$ ., and the tip itself soon becomes hollowed, forming what is called the *positive crater*.

The illustration below represents the two carbons of the arc light as they appear when



Fig. 1.—Positive and Negative Carbons

cold, the positive carbon being marked + and the negative —. The central figure is a magnified representation such as can be obtained by throwing an image of the burning carbons on a screen by means of a lens. In fig. 1 the upper rod is the positive one, and the hollowed shape of the tip is clearly shown. The negative tip becomes roughly pointed in shape, and its temperature is about half that of the positive crater.

The positive crater has an extremely high intrinsic brilliancy, and nearly the whole of the light is emitted from its surface, the negative tip and the arc itself contributing very little. In order to stabilize the arc, a series resistance of a few ohms is necessary. The carbons gradually burn away, the rate of consumption of the positive carbon being about twice that of the negative. It is, therefore, necessary to 'feed' the carbons towards one another. This may be done automatically by the action of a pair of solenoids, one carrying the current which passes through the arc, the other carrying a current

proportional to the potential difference across the arc. These solenoids, by means of a suitable mechanism, act in opposition, the current solenoid separating the carbons, and the potential difference solenoid bringing them closer together. The actions balance one another when the arc is of the correct length.

Such an arrangement also serves to strike the arc when the supply is switched on. In order to prevent the arc from wandering round the carbons, the positive carbon is cored, and sometimes the negative carbon also. The core consists of purer softer carbon of lower resistance, and the arc remains centrally placed.

*Flame Arc Lamps.*—The carbon arc principle is modified in these lamps, so that the arc itself supplies nearly the whole of the light. The arc is made highly luminous by impregnating the carbons with metallic salts, which are volatilized and become incandescent in the arc. Their presence also lowers the resistance of the arc, so that its length can be greatly increased.

The tendency of the arc to wander is also increased, so that cored carbons are essential, and their diameter must be made as small as possible. These thin carbons burn away quickly, so that they must be made proportionately longer for the same time of burning. In order to reduce their resistance a soft-metal inner core is used. The carbons, instead of being placed one above the other, are inclined at a small angle with the arc between their lower ends. The arc is made as large as possible by the action of a small electromagnet placed just above the gap.

The feeding mechanism is similar in principle to that used for ordinary carbon arcs. For street lighting, lamps of the magazine type are used. In these lamps a number of pairs of carbons is placed in the magazine, and as each carbon is used up, a new one automatically takes its place.

*Mercury Vapour Lamps.*—In these lamps the light is obtained from incandescent mercury vapour in a tube from which the air has been exhausted. The positive terminal is connected to a small iron electrode at one end of the tube. At the other end there is a small bulb, which contains a little pool of mercury, which is connected to the negative terminal. To start the lamp, the tube has to be tilted, so that a stream of mercury flows along it and makes contact with the iron electrode. The current which then flows vaporizes some of the mercury, and when the tube is tilted back to its original position, the discharge is maintained through the mercury vapour. A small series resistance is required in order to make the operation of the lamp stable. For small lamps a glass tube is used, but owing to the higher temperature reached in lamps consuming considerable power, it is necessary to use a quartz tube for large

lamps. Quartz is transparent to ultra-violet light, and to avoid harmful effects the tube is usually enclosed in a larger one of flint glass, which stops the ultra-violet rays.

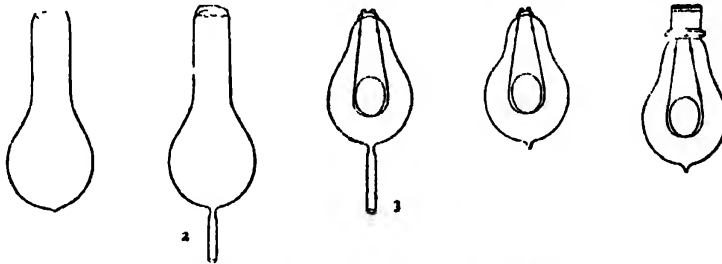
**Incandescent Lamps.**—This is the name commonly given to the type of lamp in which the light is produced by an incandescent filament. The filament is enclosed in a glass bulb, which is either exhausted to a high vacuum, or else contains an inert gas under pressure. The filament is heated to incandescence by the current passing through it.

The first lamp of this type to come into general use was the carbon filament lamp. This has now been ousted by the much more efficient tungsten filament lamp. The earlier tungsten lamps were very fragile, owing to the brittleness

be made which are not unduly bulky. For this reason, and because of their high efficiency and the absence of the need for any adjustment or attention, gas-filled lamps are coming into extensive use for street lighting and for factory and workshop lighting. Smaller lamps of this type are also being widely adopted for the illumination of shop windows.

**Electric Motors**, the name given to that division of dynamo-electric machinery in which electrical power is converted into mechanical power.

Electric motors are classified as *direct-current motors* or *alternating-current motors*, according as the electric power taken by the motor is in the form of a direct current or an alternating current. Further subdivisions of each class are made on



Stages in the Manufacture of an Incandescent Lamp

1, Bulb as received from furnace. 2, Stem attached for exhausting. 3, Filament sealed in. 4, Lamp exhausted of air. 5, Finished lamp.

of the filament. Later, a process was discovered whereby tungsten could be made malleable. The manufacture of drawn-wire filaments thus became possible, and the tungsten filament lamps which are now produced will stand a considerable amount of rough handling. This type of lamp is now in universal use for house lighting.

The limit of temperature at which the filament can be worked is set by the disintegration of the filament, which blackens the bulb and weakens the filament till it breaks. Recent research has revealed that this is due to a double chemical action between traces of water vapour and the incandescent metal. No method of entirely removing water vapour from the bulb has been found, but further research has brought to light the important fact that if the bulb is filled with an inert gas under pressure, the action is reduced to a minimum. This allows the filament to be worked at a much higher temperature, and since the light emitted increases with temperature much more rapidly than the power consumption does, the efficiency of the lamp can be greatly increased. These discoveries have led to the development of the modern *gas-filled lamp*. Owing to the high intrinsic brilliancy of the filament, high candle-power lamps of this type can

be made which are not unduly bulky. For this reason, and because of their high efficiency and the absence of the need for any adjustment or attention, gas-filled lamps are coming into extensive use for street lighting and for factory and workshop lighting.

**Direct-current Motors.**—The motor consists of a fixed magnetic field system with a rotating armature, which carries the conductors through which the supply current is passed. The magnetic field, produced in the air-gap between the poles and the armature, reacts with the current-carrying conductors of the armature and produces the *mechanical turning-moment* or *torque*.

At the same time the motion of the conductors through the magnetic field generates an E.M.F. in the conductors. This E.M.F. is in the opposite direction to the applied E.M.F., and is, therefore, called the *back E.M.F.* of the motor. The current taken by the motor is equal to the difference between the applied and back E.M.F.'s divided by the resistance of the armature winding. Since the armature resistance is always low, and the back E.M.F. is zero at starting, some form of starter is necessary in order to limit the current to a safe value. Essentially the starter consists of a suitable resistance connected in series with the armature. As the motor gains speed this resistance is gradually reduced to zero.

The speed at which a D.C. motor runs varies



inversely as the air-gap flux per pole, and very approximately, directly as the applied E.M.F. (directly as the back E.M.F. actually).

The torque produced is proportional to the product of the air-gap flux per pole and the armature current. The torque and speed characteristics of a D.C. motor, therefore, depend on the manner in which the air-gap flux per pole varies with the load current.

**Series Motor.**—In this type the field magnet windings are connected in series with the armature winding, i.e. the same current flows in both windings. The air-gap flux per pole, therefore, depends on the current taken by the motor. Consequently, at light loads the speed of the motor is very high, and there is a very large fall in speed as the load increases. The torque increases rapidly with load for the same reason. At starting, a large torque is obtained at a low

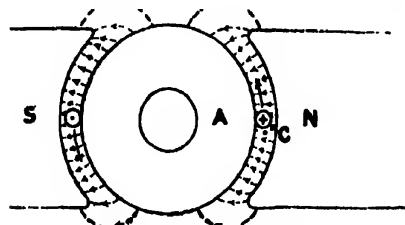


Diagram of a Simple Motor

C, Conductor on surface of iron core A, which is free to rotate between the poles N S of an electro-magnet.

speed. These characteristics are specially suitable for traction purposes, for crane motors, and for the motors for certain machine tools.

**Shunt Motor.**—In this case the field magnet windings are connected as a shunt to the armature windings, i.e. the current in the field coils depends upon the applied voltage, and is, therefore, constant in normal operation. Apart from the slight effect of the armature magneto-motive force, the air-gap flux per pole, therefore, remains almost constant at all loads. This means that the speed is practically constant at all loads (a very slight fall in speed with load occurs), and the torque, therefore, is almost directly proportional to the load current. The shunt motor is, therefore, suitable for all cases where an approximately constant speed at all loads is required.

**Alternating-current Motors.**—There are wide differences between the various types, both in construction and operation. The type most commonly used is the polyphase induction motor. In this motor both the field system and the armature consist of a slotted core built up of iron laminations. The field system is called the *stator*, and the armature the *rotor*. Both carry conductors in their slots, and these conductors in each case form a polyphase winding.

Current is supplied to the stator winding only. The currents in the rotor winding are induced by the action of the rotating magnetic field set up by the stator currents. Hence the name induction motor. For starting, a polyphase resistance completes the circuits of the rotor winding. This resistance is gradually reduced to zero as the motor attains its full speed.

The rotor circuits are, therefore, closed upon themselves in normal operation. In many motors (especially small ones which are started unloaded) the rotor winding consists of a series of copper bars brazed to solid end-rings at each end of the core, thus forming a permanently short-circuited winding. Such a rotor is known as a *squirrel-cage rotor*.

The speed characteristic of the induction motor closely resembles that of the shunt D.C. motor, and induction motors are suitable for similar purposes. The induction motor gives its maximum torque at a speed only slightly below the synchronous speed (corresponding to the number of poles in the stator winding and the frequency of the supply); and the torque decreases very rapidly as the speed rises towards synchronism. The maximum torque has a definite value for a given motor, and if the load demands a greater torque than this, the motor slows down and stops.

**Synchronous motors** are seldom used except for special purposes. They are exactly similar to the ordinary synchronous generator or alternator in construction, and the field system is almost invariably the rotating part. As their name implies, these motors have the characteristic of running at synchronous speed at all loads. If through overloading, or for any other reason, the motor is unable to maintain its synchronous speed, it immediately falls out of step and stops.

**Alternating-current Commutator Motors.**—These motors are in general appearance similar to the induction motor, but the rotor is fitted with a commutator. According to the electrical connections, these motors may be given characteristics similar to direct-current series or shunt motors. Single-phase commutator motors with series characteristics are used on the L.B. & S.C.R. electric trams.

**Electric Power Transmission and Distribution.** In the public supply of electric power in this country, the usual practice is to use alternating-current generators in the power stations, and to transmit the power at a high voltage to substations. The substation plant reduces the pressure to a value suitable to the consumer, and in many instances also converts the alternating current into direct current. From the substations the power is distributed to the consumers.

For a given amount of power transmitted the cross-section of the cables required varies inversely as the square of the voltage. In order to reduce the outlay on cables, it is important that the transmission voltage should be as high as the circumstances permit. Naturally this becomes more and more important as the distance over which the power has to be transmitted increases. In America, where large amounts of power are transmitted over very great distances, the pressure used is in some cases 150,000 volts, and the tendency is to raise this still further, as switch gear, insulators, and other apparatus capable of withstanding this high pressure are becoming available. For high-tension underground cables, the pressure now coming into common use is 20,000 volts.

The nature of the low-voltage distribution from the substations, whether alternating current or direct current, depends largely on the requirements of the consumers.

There are certain advantages in the use of direct current, and in this country it is more commonly employed than alternating current, but the substation plant is more costly and requires skilled attendance. If the circumstances are such that these advantages are not important, the lower initial cost and running expenses of an alternating-current distribution would lead to its adoption.

In the Thury system of power transmission high-voltage direct current is used throughout. Only one supply in this country is of this kind, but several are in operation on the Continent. Pressures up to 100,000 volts are used.

**Electric Telegraph.** See *Telegraph*.

**Electric Traction and Electric Tramway.**

In electric traction the mechanical power required for the propulsion of the vehicle is obtained from electric motors. These motors are usually *series direct-current motors*, but for railway work single-phase and three-phase A.C. motors have also been successfully employed (see *Electric Motors*). Up to the present, electric traction on railways has only been employed for suburban traffic in this country. In one instance (L.B. & S.C.R. electrification) single-phase alternating current is used. In all the others the power supply is direct current (see *Railways, Electrification of*).

In electric tramways, except in some few instances where there are objections to the use of an overhead construction, the current is conveyed to the motors through a trolley pole carrying a wheel running on an overhead bare copper wire. A hand-operated drum controller, directly controlling the driving and electric braking of the motors, is used. A hand-brake, and commonly a separate electro-magnetic brake, are provided.

Except in very small tramway systems, the power is generated as high-tension alternating current, and transformed and converted at substations suitably placed in the area covered by the tramway (see *Electric Power Transmission and Distribution*). The low-tension D.C. power is distributed from the substations to the trolley wire. The car rails are earthed, and provide a return path for the current. In order to minimize the flow of current to other conductors in the vicinity of the car rails, copper cables returning directly to the substation are connected to the rails at suitable intervals. These earth-return cables are connected in series with special low-voltage dynamos (called *negative boosters*) at the substation. This arrangement automatically keeps the P.D. between the most distant point of the car rails and the substation within a prescribed maximum, and effectively prevents the corrosion of pipes laid near the car rails.

**Electrode** (Gr. *hodos*, a way), a term introduced by Faraday to denote the wires or other terminals by which electricity either enters or leaves a body which is undergoing electrolytic decomposition. He called the electrode at which the current enters the *anode* (*ana*, upwards), and the electrode at which the current leaves the electrolyte the *cathode* (*kata*, downwards). (See *Electrolysis; Electro-metallurgy*.) The word is now commonly used in a wider sense to denote the conductor by which contact is made with a medium. In this way electrodes are spoken of in connection with electric furnaces, electric welding appliances, vacuum tubes, and mercury vapour lamps, although the actions are not electrolytic.

**Electrolysis** (Gr. *lysis*, loosening) is the name given to the decomposition of fused salts or solutions of salts, &c., by means of the electric current, and is thus a branch of electro-chemistry. The substance through which the current is passed is termed the *electrolyte*, and must be either an acid, base, or salt in a fused state or in solution. The current enters the electrolyte by an electrode called the *anode*, or the positive terminal. The electrode by means of which the current leaves the electrolyte is termed the *cathode*, or negative terminal.

During the passage of the current the electrolyte is decomposed, and the products of decomposition are released at the electrodes or terminals. According to the modern theory of electrolysis, all electrolytes contain a greater or smaller number of free ions. These ions are chemical radicles carrying a definite electric charge. The kind of charge, positive or negative, depends on the nature of the radicle. The ions exhibit none of the chemical properties of the uncharged radicle.

Thus, for example, in an aqueous solution of sulphuric acid, free ions of hydrogen  $H_2$ , carrying a positive charge, and free ions of  $SO_4$  carrying a negative charge, exist. An uncharged  $SO_4$  radicle would react with the water present, and sulphuric acid would be formed and oxygen liberated. The ion  $SO_4$ , however, is incapable of doing this. Owing to the nature of their charges, the hydrogen ions will move towards the negative electrode, and the  $SO_4$  ions towards the positive electrode. On reaching the electrodes the ions give up their charges, and immediately exhibit their ordinary chemical properties. Hydrogen is given off at the negative electrode, while at the positive electrode the uncharged  $SO_4$  radicle reacts with the water present, and oxygen is released.

This is an example of a secondary chemical reaction. This occurs in many cases, and where it occurs the final product is different from that first produced by the electrolytic action. Fresh ions are formed or dissociated in the electrolyte as fast as the original ions give up their charges at the electrodes. If this were not so, the electrolytic action would soon cease, since there would be no ions left to move towards the electrodes. The stream of ions carrying their positive and negative charges constitutes the current flowing through the electrolyte. Since the ions carry definite charges, it follows that the amounts of the initial products of an electrolytic action are in the ratio of their chemical equivalents. Thus, if fused silver chloride be electrolysed, for every 108 grammes of silver deposited at one side of the vessel 35.5 grammes of chlorine are given off at the other side (see *Electrode; Electro-metallurgy*).

The electrolytic action of the current is the same at all parts of the circuit. If the current is made to traverse several vessels, each containing the same substance, all in series (that is, the current that leaves the first entering the second, and so on), it will be found that in each of the cells precisely the same amount of decomposition goes on. There will be the same weight of silver deposited at one side, and a corresponding weight of chlorine set free at the other.

The same quantity of electricity decomposes chemically equivalent quantities of different electrolytes. If we pass the current through a series of cells containing different electrolytes, for example, dilute sulphuric acid, chloride of silver, sulphate of copper, and collect the products of decomposition, we find that the quantities of hydrogen, silver, and copper set free are strictly proportional to the chemical equivalents of these bodies.

The quantity of the electrolyte decomposed in a given time is proportional to the strength of the current. This fact is made use of in measuring

electric currents for standardization purposes, and the practical unit of current (the ampere) is defined, "with sufficient accuracy for all practical purposes", as being "that steady and unvarying current which deposits silver from a specified solution of silver nitrate at the rate of 0.001118 grammes per second".

The practical applications of electrolysis include the refining of copper, the electro-deposition of metals, electroplating, electrotyping, and the production of metallic sodium and potassium (see *Electro-metallurgy*). Electrolytic action is also made use of in the storage of electric energy in secondary batteries (see *Secondary Cell*).

Electro-magnetism, that branch of science which deals with the mutual relations between

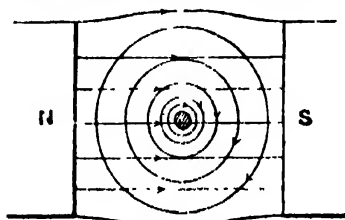


Fig. 1

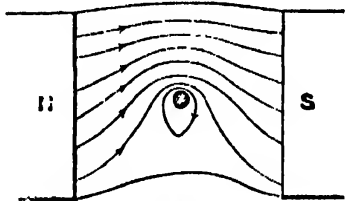


Fig. 2

electric and magnetic fields (see *Electricity; Magnetism*).

It may readily be shown that when an electric current flows in a conductor, a magnetic field is produced around that conductor, i.e. that a magnetic field is produced by the motion of an electric field. Similarly, if a magnetic field is moved at right angles to a conductor, a potential difference is established between the ends of the conductor, i.e. an electric field is produced by the motion of a magnetic field.

If a conductor is placed in a magnetic field so that its length is at right angles to the lines of magnetic force (see fig. 1), and a current is passed through the conductor, a mechanical force will act on the conductor, and this force will be at right angles both to the conductor and to the original magnetic field.

From the point of view of lines of magnetic force, the magnetic field produced by the current in the conductor (shown by the concentric circles

in fig. 1) will react with the original magnetic field (shown by the horizontal straight lines in fig. 1), and the actual resultant magnetic field will have the form shown in fig. 2. The tendency of lines of force to shorten themselves and repel one another laterally results in a force tending to force the conductor vertically downwards. This force is, of course, mutual, and tends to move the original magnetic field in the opposite direction.

All the phenomena of electro-magnetic action have their basis in these three effects, viz. (1) the production of a magnetic field by an electric current; (2) the production of an E.M.F. or P.D. by the relative motion of a magnetic field and a conductor; and (3) the mutual mechanical action between a current-carrying conductor and a magnetic field system.

The strength of the magnetic field produced by the current may be increased by winding the conductor in the form of a helix or solenoid consisting of a number of turns. The effect can be very greatly increased by providing the solenoid with a soft-iron core. The iron is strongly magnetized as long as the current flows. Such an arrangement is called an *electromagnet*. Electro-magnets specially designed to produce a very intense magnetic field are used commercially in handling scrap-iron, pig-iron, &c. The electro-magnet takes the place of the crane-hook in an ordinary crane. When the current is switched on, the pieces of iron are attracted and held firmly until the current is switched off again.

Electromagnets are also used for extracting fragments of iron or steel from the eye, and for many laboratory purposes. The most important practical use is the production of the magnetic field required in dynamo-electric machinery (see *Generator*; *Electric Motors*). The magnetic field produced within a coil in which a current flows is made use of to give the deflecting couple in certain types of galvanometers and measuring instruments (see *Galvanometer*; *Electrical Measuring Instruments*).

The absolute C.G.S. unit of current is defined in terms of the magnetic field strength produced by it, viz. "when one absolute C.G.S. unit of current flows in a circular loop of one centimetre radius, the magnetic force produced at the centre of the loop is  $2\pi$  dynes".

The principle of the electromagnetic generation of an E.M.F. is dealt with under the article *Electromotive Force*. The mechanical force produced when a current flows in a conductor placed in a magnetic field forms the basis of the action of electric motors, and certain types of galvanometers and measuring instruments. The mechanical force is a mutual one, and tends to move the conductor and the field system in opposite directions. The magnitude of the force

varies as the magnetic field strength, the length of the conductor, and the intensity of the current, and also as the sine of the angle between the field and the conductor. Thus when the direction of the lines of magnetic force is parallel to the conductor, the force is zero; and when their direction is at right angles to the conductor, the force is a maximum. The direction of the force is always at right angles both to the conductor and the direction of the lines of magnetic force. In an electric motor the forces acting on the conductors produce the mechanical output of the machine. In a generator these mechanical forces come into existence as soon as current is taken from the machine. In this case they produce a torque which is opposite in direction to the mechanical torque which is applied to the shaft of the generator in order to drive it.

**Electro - medical Apparatus.** Electrical apparatus is now widely used in the treatment and diagnosis of disease. The action of the heart may be very accurately observed by means of the electric cardiograph. The cardiograph itself consists of a very sensitive 'string' galvanometer (see *Galvanometer*) and an arrangement whereby the spot of light is focused on a moving photographic plate. In this way a photographic record of the movements of the galvanometer mirror is obtained. The galvanometer terminals are connected to two different parts of the body of the patient (say to a hand and a foot placed in separate brine baths), and the variations of potential differences which occur during a heart beat cause a movement of the galvanometer mirror.

The X-ray apparatus has recently been adapted for taking instantaneous photographs of the heart. A single powerful discharge from a static transformer takes place through the tube, and a photograph of the position of the heart at that instant is obtained. The X-ray apparatus is very well known from its use in locating fractures, foreign bodies, diseases of the bone, &c.

The X-ray discharge is used as a treatment for certain skin diseases (especially ring-worm), rodent ulcer, and cancer. Very high-frequency alternating currents may be passed through the body without producing the muscular contractions which are a feature of the passage of low-frequency currents through the tissues. Currents of considerable magnitude of very high frequency may thus be passed through the body without inconvenience to the patient. In this way general or local heating of the body may be obtained. This process is known as diathermy. The heating locally may be made sufficiently great to cause coagulation of the tissues, or even actual burning. This method is used in the treatment of tumours and other growths.

Another important electro-medical treatment consists of the local introduction of a drug, into the affected part, by electrolytic action. Thus in the treatment of rodent ulcer, a pad of lint saturated with a 5 per cent solution of zinc sulphate is placed over the ulcer. A zinc electrode is placed on the pad and connected to the positive pole of the supply. The negative pole is connected to a basin of brine in which the patient's hand is placed. The current is made as large as can conveniently be borne (say 30 to 60 milliamperes), and is maintained for about thirty minutes and then gradually reduced to zero. By this means zinc ions are carried into the ulcer. A number of diseases may be treated in this way, the ion used depending on the nature of the case.

Low-frequency intermittent currents from induction coils are frequently used where nerve stimulation or muscular contractions are required. Static electricity is also used for similar purposes. Large Wimshurst machines are used for the treatment of sciatia, and also for neurasthenia. In the latter case a brush discharge is used, and the patient experiences very little physical sensation. The high-frequency apparatus already referred to in connection with diathermy is valuable for the treatment of rheumatism in its earlier stages, and for the stimulation of the scalp in hair treatment. Suitable electrodes are passed backwards and forwards over the affected parts, a bluish brush discharge taking place between the patient and the electrode.

Electro-metallurgy is that branch of metallurgy which uses electrical energy, wholly or in part, for the extraction or treatment of metals. The energy may be converted into heat and used for processes in which high temperatures are necessary, or it may be used for the decomposition of a compound by electrolysis, which may proceed in a fused bath at a comparatively high temperature, or in a solution bath containing a compound of the metal dissolved in a suitable solvent.

The former method of utilizing the energy embraces electrothermal processes, and the latter method, electrolytic processes.

In electrothermal processes, the heat developed by the electric current has been used in a number of industries, including welding, annealing, heat treatment, smelting, refining, &c. Laboratory apparatus, such as tubes, muffles, and crucibles, are also frequently heated by means of an electric current.

For the electric welding of metals there are two systems in use: resistance welding, in which the portions to be welded are pressed together and heated by the resistance they offer to the passage of a current; and arc welding, in which portions of metal of the same composition as

that to be welded are fused on by striking an arc from a suitable electrode. In the electrical annealing of metals, case-hardened steel plates are locally softened where rivet-holes, &c., are required by passing an electric current through copper poles placed 1 or 2 inches apart on the smooth surface. Metallic wire is frequently heated to the annealing temperature between drawing operations, and various types of annealing furnaces are also electrically heated.

In electric smelting, the high temperature of the arc (3000° C.) may be used for the reduction of certain metallic oxides, which at the lower temperature of furnaces heated by coal, coke, gas, &c. (2000° C.), will not give up their oxygen to carbon; other ores are also sometimes smelted by electrical means, especially in localities where current is cheap and fuels are dear. The production of refined steel, special alloy steels, and certain non-ferrous alloys is also carried out in electric furnaces of various types.

The electric arc was first applied to fusion by Siemens in 1870; he fitted, into the bottom of a crucible to receive the charge, a water-cooled copper casing to form the positive pole, and suspended a carbon rod centrally in the crucible to form the negative pole. The current crosses the air-gap between the metal and the negative pole, forms an arc, and rapidly fuses the metal. In 1883 the Cowles Brothers, of Cleveland, Ohio, began to produce aluminum-copper and aluminum-iron alloys by arc smelting, and later produced other metals, difficult to reduce, by the same means. More recently, the development of electric smelting has made rapid strides. Electric furnaces not only yield higher temperature, but have other advantages over furnaces heated by carbon. They develop the heat in a small space, just where it is required for the operation, so that the furnace can be smaller, and less heat is lost by radiation; the charge can be kept free from gaseous products of combustion; the temperature and the whole operation is under better control; and the expense of running the furnace is limited to the time the current is used for doing useful work.

Electric furnaces are now used in the production of pig-iron, steel, ferro-alloys, brass, zinc, &c., and in the heat treatment of various metals. Classifying them according to the manner in which the electrical energy is converted into heat, we have:—

1. Direct resistance furnaces, in which the heat effect is produced within the metal itself by the resistance offered to the passage of the current through it. This type is used in the refining of steel.

2. Indirect resistance furnaces, to which class belong the various tube and crucible furnaces used in laboratories. The vessels to be heated

are wound with wire or ribbon of high resistance, such as platinum, nickel-chrome alloys, &c., and a suitable current passed. Heat-treatment furnaces on a fairly large scale also use this method, a nickel-chrome alloy ribbon being wound on a suitable framework; the heating element in these furnaces, however, generally consists of granular carbon confined in carborundum fire-sand troughs.

3. Induction furnaces, in which a primary coil of copper wire is used, the secondary being formed by the metal charge itself, contained in a suitable annular groove. In this furnace the current passes through the primary and induces a current in the charge, thus melting it. This type of furnace has been largely used in the refining of steel, and to some extent in the melting of non-ferrous metals and alloys.

4. Direct arc-heating furnaces, as exemplified in the Siemens crucible furnace mentioned above.

5. Indirect arc-heating is used in the Stassano furnace, in which the heat is obtained by radiation from the arc, and by reflection from the roof and sides of the furnace. This furnace has been used in the production of steel from scrap, and also direct from ore. There are three electrodes, which nearly meet in the centre of the furnace.

6. Combined resistance and arc furnaces are very largely used for the production of ferrous alloys, such as ferro-silicon, ferro-chrome, and ferro-manganese; for the production of steel from scrap, and for the final refining of steel produced by other processes. In these furnaces the heat is generated largely by the arc, and to a smaller extent by the resistance offered by the whole or a portion of the furnace charge to a powerful electric current. There are several well-known commercial furnaces working on this principle, the best known probably being the Héroult. This furnace is designed for tilting, and is lined with basic material, and large electrodes pass through the roof. An alternating current of 4000 amperes at 110 volts is used for a 3-ton furnace, and the intensity of the current passing through the bath is regulated by raising or lowering the electrodes.

The effect of the European War has been enormous on the development of the electric furnace in this country, for prior to the war in 1914, although the use of the electric furnace for steel-making was increasing, there were only 5 furnaces in operation in Sheffield, and two or three more in other parts of the country, producing in all about 15,000 tons per annum. Soon after the commencement of the war, it became necessary to deal with the rapidly accumulating quantity of shell turnings, to make substitutes for Swedish iron and steel, which could not be imported, and to make large quantities of special alloy steel for various war purposes. As a result of these

demands, within four years the number of electric furnaces increased to over 100, the steel produced being over 200,000 tons per annum. Since 1918 the number of furnaces has further increased, and probably reached 150 of various sizes and makes in 1920. In America a similar development has taken place, the number of furnaces increasing from 7 in 1907 to 363 in 1920, the output of electric steel in 1918 amounting to over 500,000 tons. In France, also, great strides have been made, and owing to the shortage of pig-iron, synthetic processes for its production from iron and steel scrap and ore were developed in open-pit arc-resistance furnaces, yielding 220,000 tons in 1919-8.

*Electrolytic Processes.*—The application of electrolysis for the production of metals from a fused electrolyte is most important in the case of aluminium. This metal cannot be produced by direct electrolysis in aqueous solution, but is deposited electrolytically from a fused bath of cryolite, containing alumina in solution. As the metallic aluminium is extracted from the molten bath, further quantities of purified oxide are added. The anodes consist of carbon blocks suspended in the molten bath, and the cathode consists of the carbon lining of the furnace. Calcium, cerium, lithium, magnesium, potassium, sodium, and strontium are obtained by the electrolysis of fused chlorides, sodium being also obtained from fused hydroxide and fused nitrate.

Metallic magnesium was obtained by the electrolysis of the fused chloride by Bunsen in 1852, but the application of electrolysis as a means of recovering metals from ores by means of aqueous solutions dates back to 1836, in which year Becquerel obtained copper from sulphide ores by first extracting the copper as sulphate or chloride, and then recovering the copper by the electrolysis of the solutions, using insoluble anodes. The method has since chiefly been applied to the treatment of copper ores and products, but has also been used for the recovery of nickel, gold, zinc, &c. The production of electrolytic zinc from solutions has been encouraged as a result of the shortage of pure zinc for war purposes, and several processes have been developed. In these processes the solution used consists either of zinc sulphate or of zinc chloride, the anodes consisting of metallic lead or of carbon, and the cathodes of pure zinc sheets.

It is in connection with the refining of metals that electrolytic processes become of prime importance. Elkington, in 1805, was the first to refine impure metallic copper electrolytically and recover the silver contained in it. Pure copper is now commonly obtained from impure copper anodes in an electrolyte of copper sulphate containing free sulphuric acid, a current density of 12 to 15 amperes per square foot being

used at 0.34 to 0.44 volt. Gold is also refined by a similar process, the electrolyte used consisting of gold chloride solution containing free hydrochloric acid. In this case a current density of 100 amperes at 1 volt is used. Silver is likewise refined in a silver nitrate bath, iron by the electrolysis of sulphate or chloride solution, and lead in a solution of lead fluosilicate containing free hydrofluoric acid.

In all the above-mentioned processes the anode is cast from the impure metal to be refined, and the cathode consists of a sheet or plate on which the pure metal is deposited.

It will be seen that these refining processes are very similar to electroplating methods.

**Electromotive Force**, the name given to the force tending to produce a flow of electricity in an electric circuit. The electromotive force, or E.M.F., is measured in terms of the work done in carrying unit quantity of electricity once round the circuit.

Thus unit electromotive force (absolute) is said to exist in a circuit if 1 erg of work is done in carrying 1 coulomb of electricity once round the circuit. The potential difference, or P.D. (in electromagnetic units), between two points in an electric circuit is similarly defined in terms of the work done in carrying 1 coulomb of electricity from the one point to the other.

**Production of an Electromotive Force.**—There are several sources of E.M.F., e.g. (a) chemical action, as in primary and secondary cells; (b) thermo-electric action, as in the thermopile; (c) electro-magnetic action, as in generators, motors, transformers, and induction coils.

The electromotive force due to chemical action depends on the material of the electrodes and the nature of the electrolyte, and also to a slight extent on the temperature. Thus, for any given pair of materials (say zinc and copper) immersed in a certain electrolyte of given strength (say dilute sulphuric acid), the E.M.F. produced at a given temperature has a definite value. For a discussion of the electromotive force produced by thermo-electric action, see *Thermo-electricity*.

The principle of the electromagnetic generation of an E.M.F. may be stated in its most general form as follows: If lines of magnetic force are interlinked with an electric circuit, and if by any means the number of interlinkages of the lines of magnetic force with the circuit is made to change, then an E.M.F. will be generated in the circuit, the magnitude of this E.M.F. being proportional to the time rate of change of the interlinkages. Thus, if the interlinkages are changing at the rate of one per second, one absolute unit of E.M.F. will be generated; or if the interlinkages are changing at the rate of a hundred million per second, an E.M.F. of 1 volt will be generated. It is immaterial in what

manner the change of interlinkages is brought about.

A permanent magnet may be moved so as to vary the lines of magnetic force linked with an electric circuit, as in magneto-generators; or the circuit may be moved through a magnetic field (see *Generator*; *Electric Motors*); or the magnetic field produced by a current in one coil linked with a second coil may be varied by varying the current in the first coil, as in static transformers and induction coils.

The electromagnetic generation of an E.M.F. is the fundamental principle which has made possible the generation and utilization of electrical energy on a large scale.

**Electron**, the atom of electricity, more especially of negative electricity. The first light on the question of the structure of electricity came from the laws of electrolysis (q.v.), established by Faraday. These laws are explained very naturally if we make the assumption that electricity, like matter, is atomic, the atom being the charge carried by the hydrogen ion. Clerk Maxwell even proposed to call this charge 'one molecule' of electricity, but added the remark that "it is extremely improbable that when we come to understand the true nature of electrolysis we shall retain in any form the theory of molecular charges, for then we shall have obtained a secure basis on which to form a true theory of electric currents, and so become independent of these provisional hypotheses". To-day, however, so far are we from discarding the hypothesis of the atomic nature of electricity that we find ourselves compelled by the pressure of experimental facts to interpret all electrical phenomena, in metals as well as in electrolytes, in terms of this very hypothesis. Any statical charge is supposed to be made up of a very great number of electrons, just as a material body is composed of atoms of matter. A metallic conductor is supposed to contain many free electrons, which normally bear much the same relation to the material molecules as a saturated vapour bears to the liquid in equilibrium with it. When an electromotive force is applied, it causes a drift of the electrons in the opposite direction to the force, the charge on the electrons being negative. It is this drift of electrons which constitutes an electric current.

The striking advances that have been made in our knowledge of the nature of electricity since the last years of the nineteenth century have been due chiefly to the study of the electric discharge in gases. Hittorf in 1869 and Crookes in 1879 examined the rays, now called the cathode rays, which stream from cathode to anode in a tube containing gas of very low pressure. The phenomena suggested to Crookes that the rays consist of material particles carrying



a negative charge and moving at a high speed; but many physicists rejected this explanation, holding that the rays were due to some form of wave motion in the ether. About 1897 it was conclusively shown by Perrin, Wiechert, and Sir J. J. Thomson that Crookes's view was the correct one. Sir J. J. Thomson measured the velocity of the particles, and also the ratio of the charge  $e$  to the mass  $m$  of each. His method was to subject a fine beam to the action of two fields of force, one magnetic, the other electric, and both perpendicular to the line of motion and also to each other. The electric field being  $X$ , and the magnetic field  $H$ , the forces on a particle were in the same direction, and equal to  $eX$ ,  $e v H$ . Either field by itself deflected a fine beam, as was shown by the motion of a spot of light where the beam struck a fluorescent screen. The value of  $X$  was adjusted till there was no deflection in the combined fields. Hence  $X = vH$ , and  $v$  was found from the measured values of  $X$  and  $H$ . The deflections under the two fields acting separately were also observed. Either of these deflections, when  $v$  is known, gives the value of the ratio  $e/m$ . The values of the velocity  $v$  were found to depend on the E.M.F. between the terminals of the discharge-tube. They varied from  $\frac{1}{10}$  to  $\frac{1}{2}$  of the velocity of light. The fraction  $e/m$ , however, had always the same negative value, no matter how the material of the cathode and the nature and pressure of the gas were varied.

Many other ways of obtaining these negatively charged particles, or electrons, are now known. The  $\beta$ -rays from radio-active substances (see *Radio-activity*) are simply electrons moving with great speeds, approaching sometimes within 2 or 3 per cent of the velocity of light. Hot metals give off electrons copiously; this property is used in the construction of the Coolidge X-ray tube and of the thermionic valve (q.v.). A metal plate illuminated by ultra-violet light, from an electric arc or spark, for instance, gives off electrons moving at all velocities below a certain maximum (see *Photo-electric Effect*). From whatever source the electrons are derived, their properties are found to be the same.

The determination of  $e$  and  $m$  separately is a much more difficult matter than the determination of their ratio. The first attempt to measure  $e$  directly was made by Townsend, and published in 1897. Townsend obtained his ions in the hydrogen and oxygen given off when caustic potash is electrolyzed. The charged gases when bubbled through water formed a cloud. This cloud could be completely removed by bubbling through concentrated sulphuric acid but reappeared when the gas came out again into the atmosphere, owing to the condensation of water-vapour on the ions. Townsend determined the

weight of the cloud and its total charge. He also found the average weight of the minute spherical drops forming the cloud by observing their rate of fall under gravity, and calculating their radius from a theoretical formula known as Stokes's law, viz.  $v = \frac{2}{9} \frac{ga^2\rho}{\eta}$ , where  $a$  is the

radius,  $\rho$  the density,  $v$  the velocity of the drop, and  $\eta$  is the viscosity of air. The weight of the cloud divided by the weight of a drop gave the number of drops, which was presumably the same as the number of ions. Finally, dividing the total charge by the number of ions, Townsend found  $e$ , the average charge carried by an ion. His value came out about three-fifths of the value accepted now.

This pioneer method of Townsend's has been improved and modified in various ways by C. T. R. Wilson, Sir J. J. Thomson, H. A. Wilson, and notably by Millikan, of Chicago. Millikan's charge carriers were minute oil drops, which were given elementary charges by means of ionizing rays from radium. Observations were made of the equilibrium and motion of these charges under the combined influence of gravity and a strong vertical electric field, the intensity of which could be varied at will. A single drop could be kept in view for several minutes at a time, and note was taken of the effect of each new charge as it was picked up by the drop. On calculation, the charge was found in all cases to have very approximately the same value. It so happened, as a consequence of the method of producing the drops, that they carried a small fractional charge, and incidentally Millikan was able to verify that this was always an integral multiple of the electronic charge  $e$ . Millikan's result, which is almost probably the best yet found, is that  $e = 4.774 \times 10^{-20}$  absolute electrostatic units, or  $1.591 \times 10^{-20}$  absolute electromagnetic units.

An indirect but very interesting method of determining  $e$  was devised independently by Regener and by Rutherford and Geiger. The special feature of this method is the actual counting of the number of  $\alpha$ -particles (see *Radio-activity*) shot out per second through a given solid angle by a small speck of radium. Each  $\alpha$ -particle produces a scintillation on a sensitive screen placed in its path, and these scintillations are counted one by one by the observer. The total quantity of electricity carried by the  $\alpha$ -particles emitted in one second is measured independently. The charge on each particle is then found by simple division. This charge is found to be almost exactly twice Millikan's value for  $e$ , as it ought to be, as it is practically certain that the  $\alpha$ -particle is an atom of helium which has lost two electrons.

The value of  $e/m$ , as determined by Thomson's

method described above, is  $1.76 \times 10^7$  e.m.u. per gramme, or  $5.29 \times 10^{17}$  e.s.u. per gramme. Taking this with Millikan's value for  $e$ , we find  $m = 0.002 \times 10^{-27}$  grammes. The exact determination of  $e$  has made it possible to assign precise values to several other important physical constants, which formerly were only known roughly from data depending on the Kinetic Theory of Gases. Thus Avogadro's constant  $N$ , or the number of molecules in one gramme-molecule (molecular weight in grammes) of any gas can be connected with  $e$  by the exact measurements of electrolysis, which give  $Ne = 9650$  e.m.u. It follows that  $N = 6.06 \times 10^{23}$ , and that the number of gas molecules per cubic centimetre at  $0^\circ$  C and 76 centimetres pressure is  $2.70 \times 10^{19}$ . We find at once also the mass of the hydrogen atom as  $1.66 \times 10^{-24}$  grammes, the density of hydrogen being known to be .089 grammes per litre. The mass of the electron is therefore about  $1/1840$  of the mass of the hydrogen atom, which till the isolation of the electron was the smallest mass known.

It is necessary, however, to scrutinize with some care the meaning of the word mass as applied to an electron. The determination of the mass of the hydrogen atom ultimately depends on weighing, that is, on finding its gravitational inertia. We cannot weigh an electron, but must determine its mass by experiments involving its motion, the word mass here meaning the ratio of the force acting on the electron to the acceleration produced, and the force being calculated from the charge and velocity of the electron on the principles of electrodynamics. An electron being entirely different in its physical nature from ordinary matter, the question arises whether its mass, as calculated in this way, is actually a definite constant, as it is for a material particle, according to the accepted principles of Newtonian dynamics. It can even be shown, as was first done by Sir J. J. Thomson, that a moving charged body possesses inertia in virtue of the mere fact that it carries a charge. The value of this inertia, or electromagnetic mass, when the velocity is small compared with that of light is, in a vacuum, for a small sphere of radius  $a$ ,  $\frac{2}{3}e^2/a$ , where  $e$  is the charge. If the velocity is greater than, say,  $\frac{1}{10}$  the velocity of light, the formula for the electromagnetic mass is more complicated, and, indeed, cannot be calculated without some assumption as to the internal distribution of charge in the electron itself. Two formulae for the mass have been given, one by Abraham, the other by H. A. Lorentz. Abraham started from the supposition that the electron is a rigid sphere carrying a uniform surface charge. Lorentz showed that a simpler theory could be obtained by the hypothesis that the electron contracts, in the direction of its

motion, by a certain definite amount depending on its velocity. On both theories the value found for the mass depends on the relation between the direction of the force and the direction of the motion. On Lorentz's theory the longitudinal mass, or mass when the force is in the direction of the motion, is  $m_0/(1 - \beta^2)^{3/2}$ ; and the transverse mass, or mass when the force is perpendicular to the velocity, is  $m_0/(1 - \beta^2)^{1/2}$ ; where  $m_0$  is the mass for very small speeds, and  $\beta$  is  $v/c$ , the ratio of the velocity of the electron to the velocity of light. The two theories have been tested by various experimenters, with somewhat conflicting results. On the evidence of experiments by Bucherer, however, Lorentz's theory of the contractile electron is now generally accepted, and it is regarded as highly probable that electrons are devoid of all mass except the electromagnetic mass due to their charge of negative electricity.

No fundamental positive electron has been isolated which at all corresponds to the negative electron, or corpuscle, as it is called by Sir J. J. Thomson. The nearest approach to a positive electron is the nucleus of the hydrogen atom, which carries a positive charge of the same magnitude as the charge on an electron. Practically the whole mass of the atom resides in this nucleus. According to the modern theory of the structure of matter, the neutral atom of any element is built up of a comparatively small number of electrons and an equal number of these positive nuclei. Electrons being present everywhere, and their action influencing all natural phenomena, their properties will naturally come up for consideration from various points of view in other articles. See *Ionization; Isotopes; Matter; Radio-activity; Rays, Electric*. —BIBLIOGRAPHY: J. A. Crowther, *Ions, Electrons, and Ionizing Radiations*; R. A. Millikan, *The Electron*, N. R. Campbell, *Modern Electrical Theory*; O. W. Richardson, *The Electron Theory of Matter*; H. A. Lorentz, *Theory of Electrons*.

**Electro-plating**, the process of depositing a coating of some selected metal on a given surface by means of electrolysis (q.v.). The most important classes of electro-plating commonly carried out are nickel-plating, used very largely for a variety of articles made of iron, steel, &c.; copper-plating, used for facing printing-blocks and as a first coating to non-metallic substances prior to silver- or gold-plating; silver-plating, for imitation silverware and for cutlery, &c.; gold-plating, for ornamental ware, jewellery, &c. Previous to plating it is necessary to remove all grease, dirt, oxide, &c., from the surface, this cleansing of the articles being the first step in the operations necessary. The exact procedure for cleansing varies with the nature of the articles to be plated, but for the removal of grease a

strong caustic alkali bath is generally used. To remove oxide and dirt, scratch-brushing is used, also scouring with pumice-stone. Acid-dipping baths are also employed, muriatic acid or sulphuric acid for iron or steel articles, dipping-acid, which is a mixture of sulphuric acid and nitric acid, for brass. For the actual deposition an electrolytic cell is prepared, containing a solution of a suitable salt of the metal to be deposited, with an anode, generally consisting of a plate of the same metal, attached to the positive pole of the battery used, the article to be treated being connected with the negative pole and thus forming the cathode. When a current of electricity is passed through the solution, a thin coating of metal is deposited on the article forming the cathode, and an equivalent portion is carried into solution from the anode. In the case of nickel-plating, the solution used is made from the double chloride or sulphate of nickel and ammonium, to which salt, sal-ammoniac, &c., may be added. The bath is used at a temperature of 100° F., and cast-nickel plates are used as anodes. For copper-plating the bath used generally consists of an acid solution of sulphate or acetate of copper, cyanide of potash also being added; in case the article is made of zinc, an alkaline bath is used. The bath may be used cold, but is sometimes kept at about 120° F. For iron simple dipping is sometimes used, as copper is readily deposited on iron without the use of an electric current. For electro-plating of copper, anodes of metallic copper, having a surface equal to that of the articles to be coated, are used. For silver-plating the solution consists of the double cyanide of silver and potash, and may be used either hot or cold. An article to be silver-plated is often prepared by a preliminary dip in a solution of nitrate of mercury, which causes a slight amalgamation with mercury. After this preliminary treatment it is placed in the bath and a slight deposit of silver obtained, after which it is removed, well brushed, washed, and replaced in the bath. A silver plate is used as an anode. A density of 1½ to 1¼ ounces of silver to the square foot gives an excellent plate about the thickness of common writing-paper. In gold-plating baths, a hot solution of the double cyanide of gold and potash is used at 170° F., and for the anode platinum foil is frequently used, the strength of the bath being maintained by the addition of fresh quantities of chloride of gold. After all kinds of plating as described above, the goods are thoroughly washed in water, and dried by means of saw-dust or in a drying-chamber. In ordinary circumstances the deposited metal presents a dead or matted appearance, and if a bright polished effect is desired, it is burnished and buff-polished,

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Certain chemicals added to the solution will cause the original deposit to have a metallic lustre.

**Electrotype.** The production of copper facsimiles by the electric current is called *electrotype*, and is the oldest branch of electro-metallurgy. One of its most important applications is the copying of type set up for printing, and of wood blocks for wood-cuts. A mould is first obtained in gutta-percha or some similar material. This, being a non-conductor, is brushed over with plumbago in its interior, so as to give it a conducting surface to receive the deposit. After several hours the deposit is detached from the mould and backed by pouring in melted solder, the surface being first moistened with chloride of zinc to make the solder adhere. In the copying of steel engravings the mould is obtained by electro-deposition of copper on the steel, the surface of which must first be specially prepared to prevent adhesion; and a second electro-deposition of copper, on the mould thus obtained, gives the required copy, from which impressions can be printed.

**Electrum** (Gr. *ēlektron*), in antiquity, a term applied to native gold, which frequently contains notable quantities of silver, copper, and other metals. According to Pliny, the term *electron* was applied to native gold containing at least 20 per cent of silver. The term was afterwards transferred from this native alloy to the artificial alloy of gold and silver on account of its colour and inferior lustre. The word originally meant 'amber', and was given to impure gold on account of a supposed resemblance. *Electrum* was used since the eighth or seventh century B.C.

**Elec'tuary, or Confection**, is a pharmacopœial preparation. It is solid, but of soft consistence, and contains sugar or honey, impregnated with some more active body. The best known is the confection of senna.

**Ele'git**, in English law, a writ by which a creditor who has obtained a judgment against a debtor, and is hence called the *judgment-creditor*, may be put in possession of the lands and tenements of the person against whom the judgment is obtained, called the *judgment-debtor*, until the debt is fully paid. The writ is addressed to the sheriff, who enforces it. The writ of *elegit* was first authorized by the Statute of Westminster the Second, which gave the *judgment-creditor* the right to choose between a writ against the debtor's land, and until 1833 his goods also, and an execution by writ against the latter's person or chattels. The new writ, representing the choice of the creditor, was therefore called an *elegit*, Lat., he has chosen. See *Fiert Facias*.

**El'egy** (Gr. *elegos*, mourning, song), a mourn-

ful and plaintive poem or funeral song, or any serious poem of a melancholy contemplative kind. In classic poetry what is known as *elegiac verse* is composed of couplets consisting of alternate hexameter and pentameter lines. In English we generally understand by elegies lyric poems which are laments over the dead, such as Milton's *Lycidas*, or Shelley's *Adonais*.

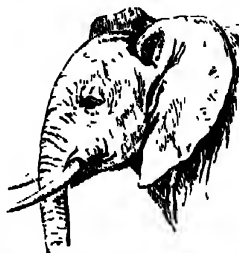
**Elemental Spirits**, according to a belief common in the Middle Ages, spirits proper to and partaking of the four so-called elements, viz. salamanders or fire spirits, sylphs or aerial spirits, gnomes or earth spirits, and undines or water spirits.

**Elements**, the simplest constituent principles or parts of anything; in a special sense, the ultimate indecomposable constituents of any kind of matter. In ancient philosophies the term was applied to fire, air, earth, and water. The mediæval chemists, however, absorbed in the study of metals and mineral substances, supposed that the metals consisted of an elemental sulphur and an elemental mercury mixed together more or less perfectly and in different proportions. To these were subsequently added salt and some others, so that about the middle of the seventeenth century the first principles amounted to five, divided into two classes; the active, consisting of mercury or spirit, sulphur or oil, and salt; and the passive, consisting of water or phlegm, and earth or the terrestrial part. The names remained, not so much as denoting substances or ultimate principles as gradually coming to denote functions; the first great modification being the expansion of the idea of elemental sulphur into phlogiston by Stahl, as the result of which the adherents of the phlogistic theory applied the term phlogiston to the gases then discovered, the mineral, vegetable, and animal acids, the alkalis, earths, and metallic calces, oil, alcohol, and water. The substances considered as simple naturally changed with the change of theory introduced by Lavoisier, who considered as elements, oxygen, nitrogen, hydrogen, sulphur, phosphorus, and carbon, the metals and the earths, and, as Boyle had already suggested, practically defined an element as a body not yet decomposed, the definition now commonly adopted. For list of known elements see *Chemistry*.

**Elemi**, the fragrant resinous exudation from various trees, such as the *Canarium commune*, from which the Eastern or Manila elemi is obtained; the *Ictea Ictantha*, the source of the American or Brazilian elemi; and the *Elaphrium elemiferum*, from which the Mexican elemi comes. It is a regular constituent of spirit varnishes, and is used in medicine, mixed with simple ointment, as a plaster.

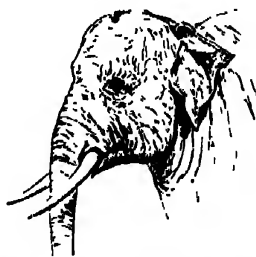
**Elephant**, the popular name of a genus,

family, or sub-order of five-toed proboscidean mammals, usually regarded as comprehending two species, the Asiatic (*Elephas indicus*) and the African (*E. africanus*). From a difference in the teeth, however, the two species are sometimes referred to distinct genera (*Euelephas* and *Loxodon*). The so-called white elephants are merely albinos. The African elephant is distinguished from the Asiatic species by its greater height, its larger ears, its less elevated head and



Head of African Elephant (*Elephas africanus*)

bulging or convex forehead, the closer approximation of the roots of the tusks, and the greater density of the bone. It has also only three external hoofs on the hind-feet, while the Asiatic has four. All elephants are remarkable for their large, heavy, short bodies supported on columnar limbs, a very short neck, a skull with lofty crown



Head of Indian Elephant (*Elephas indicus*)

and short face-bones, with the exception of the premaxillaries, which are enlarged to form tusk-sockets. To compensate for the short neck, they have the long proboscis, often 4 or 5 feet in length, produced by the union and development of the nose and upper lip. It is made up of muscular and fibrous tissue. The trunk is of great strength and sensibility, and serves alike for respiration, smell, taste, suction, touch, and prehension. The tusks, which are enormously developed upper incisor teeth, are not visible in young animals, but in a state of maturity they project in some instances 7 or 8 feet. The largest on record (undoubtedly that of an extinct species) weighed 350 lb. Elephants sometimes attain the height of 12 feet or more, but their general height

is about 9 or 10 feet. Their weight ranges from 4000 to 9000 lb. The period of gestation is twenty months, and the female seldom produces more than one calf at a birth: this, when first born, is about 3 feet high, and continues to grow till it is sixteen or eighteen years of age. It is said that they live to the age of 150 years. They feed on vegetables, the young shoots of trees, grain, and fruit. They are polygamous, associating in herds of a considerable size under the guidance of a single leader. An elephant leaving or driven from a herd is not allowed to join another, but leads a lonely, morose, and destructive life. Such solitary elephants are known as 'rogues'. Elephants are caught either singly or in herds. In the former case it is necessary to catch adroitly one of the elephant's legs in the noose of a strong rope, which is then quickly attached to a tree; another leg is then caught, until all are securely fastened. His captors then encamp beside him, until under their treatment he becomes tractable. When a herd is to be caught a strong enclosure is constructed, and into this the elephants are gradually driven by fires, noise, &c. With the aid of tame elephants the wild ones are tied to trees and subjected to the taming process. The domesticated elephant requires much care, and a plentiful supply of food, being liable to many ailments. The daily consumption of a working elephant is, according to Sir J. E. Tennent, 2 cwt. of green food, about half a bushel of grain, and about 40 gallons of water. Their enormous strength, docility, and sagacity make them of great value in the East for road-making, bulking, and transport. They are used by the great on occasions of pomp and show, being often richly caparisoned, and bearing on their back a howdah containing one or more riders, besides the mahout or driver sitting on the animal's neck. Tiger-shooting is often practised from an elephant's back. Several extinct species are known, the most notable being the mammoth (*E. primigenius*), a contemporary of prehistoric man. The allied genus *Mastodon* was of very wide distribution, and the Tertiary deposits of the Fayum (Egypt) have yielded the remains of types that bridge over the gap between elephants and more typical quadrupeds. See *Mammoth*; *Mastodon*.—BIBLIOGRAPHY: Anderson, *The Lion and the Elephant*; Sir J. E. Tennent, *The Wild Elephant in Ceylon*; Sander-son, *Wild Beasts of India*; R. Lydekker, *The Game Animals of Africa*.

**Elephan'ta Isle**, or **Gharapuri**, a small island in the Bay of Bombay, between Bombay and the mainland, 6 miles north-east of the former; circumference about 5 miles. It consists of two long hills chiefly overgrown with wood. A city is supposed to have flourished

on the island between the third and tenth centuries, but now it has only a few inhabitants, who rear sheep and poultry for the Bombay market. It is celebrated for its rock temples or caves, the chief of which is a cave-temple supposed by Fergusson to belong to the tenth century, 130 feet long, 123 broad, and 18 high. It is supported by pillars cut out of the rock, and containing a colossal figure of the trimurti or Hindu Trinity: Brahma, Vishnu, and Siva. The temple is still used by the Banu caste for the Siva at certain festivals.

**Elephant-fish** (*Callorhynchus antarcticus*), a fish of the sub-class Elasmobranchii (rays and sharks), so named from a proboscis-like structure on the nose; called also Southern Chimaera. It inhabits the Antarctic seas, and is palatable eating.

**Elephantiasis** is a disease characterized by progressive enlargement of a limb, or portion of the body, and occurs most frequently in the legs. The enlargement begins below the knee and gradually involves the entire limb. The onset may be slow and painless, or sudden with fever and rapid swelling. The disease is common in all countries in which the Filarie prevail. No drug destroys the embryos in the blood, and in infected districts the drinking-water should be boiled or filtered. In rapid cases rest, liquid diet, purgation, and firm bandaging of the legs are indicated. Surgical treatment for removal of adult Filarie in enlarged glands has met with some success.

**Elephant'ne**, the Greek name of a small island of Egypt, in the Nile, just below the First Cataract and opposite Assuan (Syene). It is partly covered with ruins of various origins—Egyptian, Roman, Sarcen, and Arabic, the most important being a gateway of the time of Alexander, a small temple dedicated to Khnum and founded by Amenophis III, and the ancient Nilometer mentioned by Strabo. The latter was restored in 1870 by the Khedive Ismail Pasha. The northern part is low, the southern elevated and rocky.

**Elephant Lore.** The cult of the elephant is found among many nations in Asia and Africa. It exists in Indo-China, Cambodia, Abyssinia, Siam, and Sumatra. The Aryo-Indian god Indra rides on an elephant. Buddha had a white elephant form. One of the Sanskrit names for the elephant is *Naga*, which connects the animal with the sacred snake, possibly on account of its trunk; another name is *Hastin*, 'having a hand'. The Wambuegs believe the elephant to be the abode of the souls of their ancestors. It is a bad omen, according to the *Talmud*, to dream of an elephant.

**Elephant River**, a river of Cape Colony, running into the Atlantic after a course of 140 miles.

Elephant-seal, the Proboscis Seal, or Sea-elephant, the largest of the seal family (Phocidæ). There are probably two species, one (*Macrorhinus angustirostris*) found only on the coast of California and Western Mexico, the other (*Macrorhinus leoninus*) found in Patagonia, Kerguelen Island, Heard's Island, and other parts of the Southern Seas. They vary in length from 12 to 30 feet, and in girth at the chest from 8 to 18 feet. The proboscis of the male is about a foot long when the creature is at rest, but elongates under excitement. The females have



Elephant-seal

no proboscis and are considerably smaller than the male. Both species are becoming rare owing to the wholesale slaughter of them which takes place.

Elephant's-foot, the popular name of *Testudinaria elephantipes*, a plant of the nat. ord. Dioscoreaceæ (yams, &c.), distinguished by the shape of its rootstock, which forms a nearly hemispherical mass rising a little above the ground, covered with a thick corky bark. It has a slender climbing stem growing to a length of 30 or 40 feet, with small heart-shaped leaves and greenish-yellow flowers. It is known in the Cape Province as Hottentots' Bread.

Eleusi'ne, a genus of grasses, several of which, e.g. *E. coracana*, are cultivated as grain plants in India, Japan, and Tibet.

Eleusinian Mysteries, the sacred rites anciently observed in Greece at the annual festival of Demêtêr or Ceres, so named from their original seat Eleusis. According to the Homeric hymn to Demêtêr, the goddess, while wandering in search of Persephone, came to Eleusis, where she was hospitably received by King Celeus. He directed the establishment of a temple in her honour, and showed the use of grain to Triptolemus and other princes. As a preparation for the greater mysteries celebrated at Athens and Eleusis, lesser Eleusinia were celebrated at Agræ on the Ilissus. The greater Eleusinia were celebrated in the month Boedromion (September-

October), beginning on the 15th of the month and lasting nine days. The celebrations, which were varied each day, consisted of processions between Athens and Eleusis, torch-bearing and mystic ceremonies attended with oaths of secrecy. They appear to have symbolized the old conceptions of death and reproduction, and to have been allied to the orgiastic worship of Dionysus (Bacchus). They are supposed to have continued down to the time of Theodosius I.

Eleu'sis, in ancient geography, a small city of Attica, about 14 miles from Athens, near the shore opposite the Island of Salamis. Its temple of Demêtêr was one of the most beautiful buildings of Greece. The sacred buildings were destroyed by Alaric in A.D. 390. In 1882 the Greek Archaeological Society undertook excavations, and numerous remains have been unearthed. There is now a large straggling village here.

Eleu'thera, one of the largest of the Bahama Islands. It is of very irregular shape, its length being about 70 miles, and its breadth in general from 2 to 4 miles, though in one part 10. Pop. 6533.

Elevation. In astronomy, the elevation of an object above the horizon is measured by the arc intercepted between the horizon and the object on the circle which passes through the object and the zenith. In geometry, solids can be represented by means of two projections; one on a horizontal plane, and the other on a plane perpendicular to the horizontal. The former is called the plan, and the latter the elevation.

Elevation of the Host (Lat. *hostia*, a victim), in the ritual of the Mass, is the lifting up of the elements immediately after consecration, to be worshipped by the people. It was introduced into the Latin Church in the eleventh century, in consequence of the denial by Berengarius of the real presence in the sacrament. The Council of Trent ordered that the host should be worshipped with the highest adoration, that of *latría*, which is offered to God only.

El'elevator, (1) a mechanical contrivance consisting of a series of boxes or buckets attached to a belt travelling round two drums, one above and one below, for hoisting grain, meal, coal, coke, &c. In America large buildings which contain such contrivances, and in which grain is stored, receive the same name. (2) An apparatus for raising or lowering persons or goods to or from different levels in warehouses, hotels, &c., consisting usually of a cage or movable platform worked by hydraulic power: also called a *lift* or *hoist*.

Elf-arrows, Elf-bolts, or Elf-shot, popular names in Europe for stone arrow-heads and axes. They were worn as charms against light-

ning; cattle and men are said to have been struck and wounded by them. In the Far East they are 'thunder-stones'.

Elgar, Sir Edward, English composer, was born at Broudeheath, Worcestershire, 2nd June, 1857. For some time he acted as conductor of the Worcester Instrumental Society, and as organist at St. George's, Worcester, but when later he turned to composition he resigned both these positions. In 1892 he produced *The Black Knight*, and this was followed by several oratorios, cantatas, and other works, including *The Light of Life*, a short oratorio (Worcester Festival, 1896); *King Olaf*, a cantata (North Staffordshire Festival, 1896); *Imperial March* (1897); *Te Deum* (Hereford Festival, 1897); *Caractacus* (Leeds Festival, 1898); and *Orchestral Variations* (1899). In 1900 his famous sacred cantata, *The Dream of Gerontius*, was produced at the Birmingham Festival (repeated at Dusseldorf in 1901 and at the Niederrheinische Musik Fest in 1902), and added immensely to his already considerable reputation. In 1902 the *Coronation Ode* proved extremely popular, and in 1903 the Birmingham Festival introduced *The Apostles*, a fine oratorio, which, like the *Gerontius*, was honoured at the Niederrheinische Musik Fest the following year. In March, 1904, an 'Elgar Festival', lasting three days, was held at Covent Garden, London, at which, in addition to *The Dream of Gerontius*, *The Apostles*, and other compositions by Dr. Elgar, was produced *Alassio*, a new concert overture, the outcome of a visit to Italy. In 1904 Dr. Elgar was knighted. From 1905 to 1908 he was professor of music at Birmingham University. He has received musical and other degrees from Oxford, Cambridge, and Yale.

Elgin, James Bruce, eighth Earl of, and twelfth Earl of Kincardine, Governor-General of India, born in 1811, died in 1863. Educated at Eton and Christ Church, he entered Parliament in 1841 as member for Southampton, and in the same year succeeded to the earldom. He was appointed Governor-General of Jamaica in 1842, and in 1846 Governor-General of Canada. In 1849 he was raised to the British peerage as Baron Elgin of Elgin. In 1857 he went as special ambassador to China, and concluded the Treaty of Tientsin (1858). In 1859 he became Postmaster-General in Palmerston's Cabinet, in 1860 was sent on a special mission to Peking, and in 1861 became Governor-General of India.—Victor Alexander Bruce, ninth Earl of Elgin, son of the preceding, born 1840, died 1917, was also Governor-General of India (1894-9), and Colonial Secretary in the Campbell-Bannerman Ministry from Dec., 1905, to April, 1908.

Elgin (el'gin), a royal and parliamentary burgh of Scotland, capital of Elgin County,

situated on the Lossie, about 5 miles from its influx into the Moray Firth, 70 miles N.W. of Aberdeen. The town largely consists of mansions and villas. The most interesting edifice is the cathedral, now in ruins, which was once the most magnificent in Scotland. It was founded by Bishop Andrew Moray in 1224; plundered and burned in 1390 by the 'Wolf of Badenoch', and again in 1402 by Alexander, third son of the Lord of the Isles; restored 1390 to 1424; and again plundered in 1568. Until 1918 the Elgin Burghs sent one member to the House of Commons. Pop. 8656.—*Elgin*, county of, also called Morayshire, is a maritime county, bounded by the Moray Firth, Banffshire, Inverness-shire, and Nairnshire; area, 340,000 acres. Along the sea-coast, which extends for more than 30 miles, the surface is flat, but inland it rises into hills of moderate elevation, intersected by fine and fertile valleys. The chief rivers are the Spey, Lossie, and Findhorn, the Spey and Findhorn having excellent salmon fishing. Inexhaustible quarries of freestone (rich in fossils) are worked. The climate is noted for its general mildness, dryness, and salubrity. The lower tracts of land are fertile and highly cultivated, the principal crops being wheat, oats, potatoes, and turnips. The great majority of farms are small. A portion of the surface is still covered with native forests. The county unites with Nairnshire in returning one member to the House of Commons. Pop. 43,427.

Elgin, a town of the United States, in Illinois, on Fox River, 36 miles N.W. of Chicago. It has a watch-factory and various flourishing industries. Pop. 25,976.

Elgin Marbles, the splendid collection of antique sculptures brought chiefly from the Parthenon of Athens to England by the seventh Earl of Elgin (1766-1841) in 1814, and afterwards purchased by Parliament for the British Museum at the cost of £35,000. They consist of figures in low and high relief and in the round, representing gods, goddesses, and heroes; the combats of the Centaurs and Lapithæ; the Pan-athenæic procession, &c. They exhibit Greek sculpture at its highest stage, and were partly the work of Phidias. The historical and artistic value of the Elgin marbles was at first doubted, and Lord Elgin himself was not spared. His act in removing the marbles was denounced as vandalism.

El Hasa, a fertile district of Eastern Arabia, on the Persian Gulf. It produces dates, wheat, millet, and rice. Pop. estimated at 175,000.

Eli, one of the Hebrew judges, the predecessor of Samuel. He was high-priest and judge for forty years, but was less successful as head of his own household. His two sons having been slain, and the ark taken in battle by the Philistines, the



news proved so severe a shock that he fell and broke his neck, at the age of ninety-eight. Little is really known of the history of Eli, since he is only shown to us in the weakness of old age, unable to control his sons Hophni and Phinehas, whose wickedness disgusted and alienated the people.

Eli'jah, the most distinguished of the prophets of Israel, flourished in the ninth century B.C., during the reigns of Ahab and Ahaziah, and until the beginning of the reign of Jehoram, his special function being to denounce vengeance on the kings of Israel for their apostasy. He incurred the anger of Jezebel, wife of Ahab, for slaying the prophets of Baal, but escaped to Horeb, afterwards returning to Samaria to denounce Ahab for the murder of Naboth. Elijah at length ascended to heaven in a chariot of fire, Elisha, his successor, being witness. See *1 Kings*, xvii to xvi, and *2 Kings*, i and ii.

Elimination, in mathematics, the process of treating a given set of equations so as to deduce from them an equation free from a selected letter, or from several selected letters. For instance, if the system of equations

$$\begin{aligned}a_1x + b_1y + c_1z &= 0, \\a_2x + b_2y + c_2z &= 0, \\a_3x + b_3y + c_3z &= 0,\end{aligned}$$

has a solution in which one at least of  $x, y, z$  is different from zero, then

$$\begin{aligned}a_1, b_1, c_1 \\a_2, b_2, c_2 \\a_3, b_3, c_3\end{aligned}$$

(See *Determinant*.)—BIBLIOGRAPHY: Burnside and Panton, *Theory of Equations*; Salmon, *Higher Algebra*.

Eli'ot, George, the assumed literary name of Mary Ann, or, as she preferred to write the name in later years, Marian Evans, English novelist. She was the daughter of a Warwickshire land-agent and surveyor, was born at Griff, near Nuneaton, on 22nd Nov., 1820, and died on 22nd Dec., 1880. She received at Coventry an excellent education, comprising the classical and modern languages, and shortly after her twenty-first year became a convert to Rationalism. Her first literary undertaking was the completion of Mrs. Hennell's translation of Strauss's *Life of Jesus* (1840). Towards the end of her task she seems, however, to have wearied of it, and when the work appeared she declared herself 'Strauss-sick'. After spending two years' abroad, she boarded at the house of John Chapman, editor of the *Westminster Review*, of which she became sub-editor. It was not, however, until January, 1857, that she came prominently into public

notice, when the first of a series of tales entitled *Scenes from Clerical Life* appeared in *Blackwood's Magazine*. The series came to an end in Nov., 1857, and in the following year the publication of *Adam Bede* placed her in the first rank of writers of fiction. It was succeeded by *The Mill on the Floss* (1860), *Silas Marner* (1861), *Romola* (1863), *Felix Holt* (1866), *Middlemarch* (1872), and *Daniel Deronda* (1876). In addition to those prose works she published three volumes of poems, *The Spanish Gypsy* (1868), *Agatha* (1869), and *The Legend of Jubal* (1874). Her last work published during her life was the series of essays entitled *The Impressions of Theophrastus Such* (1879), but a volume of mixed essays was issued posthumously. For many years she was happily associated both in life and work with George Henry Lewes, though a legal union was impossible during the lifetime of Mrs. Lewes. In May, 1880, after Lewes's death, she married Mr. John Cross, but did not survive the marriage many months, dying rather suddenly at Chelsea.—BIBLIOGRAPHY: Eaton, *George Eliot in Derbyshire*; J. W. Cross (editor), *George Eliot's Life as Related in Her Letters and Journals* (3 vols.); O. Browning, *Life of George Eliot*; Deakin, *The Early Life of George Eliot*; Sir Leslie Stephen, *George Eliot* (in *English Men of Letters Series*).

Eliot, Sir John, one of the ablest of the popular leaders of Charles I's reign, of an old Cornwall family, born in 1592, died in 1632. He entered Parliament in 1614 as member for St. Germans, winning immediate reputation as an orator. As vice-admiral of Devon he was energetic in suppressing piracy. In the three Parliaments of 1623, 1625, 1626, he made his way to the front of the constitutional party, joined Hampden and the rest in refusing contributions to the forced loan, and took a prominent share in drawing up the Remonstrance and Petition of Right. He was imprisoned in the Tower in 1629, and died in confinement. During his imprisonment he wrote a work on constitutional monarchy entitled *The Monarchie of Man*. Among his other works are: *An Apology for Socrates*, and *Negotium Posterorum* (an account of the Parliament of 1625).

E'lis, a maritime state of ancient Greece in the west of the Peloponnesus, bordering on Achæa, Arcadia, and Messenia, and watered by the Rivers Alphæus and Penæus. Of its capital Elis (now Kaloskopi) there are few traces. Olympia, where the famous games were held, was near the Alpheus. Since 1809 Elis forms a nomarchy of Greece.

Eli'sha, a Hebrew prophet, the disciple and successor of Elijah. Many miracles of prediction and cure, and even of raising the dead, are ascribed to him, but his figure is less original and heroic than that of his master. He held the

office of prophet for fully sixty-five years, from the reign of Ahab to that of Joash (latter half of ninth century B.C.).

**Elixir**, a word of Arabic origin (*al iksir*, the philosopher's stone), applied by the alchemists to a number of solutions employed in attempting the transmutation of metals into gold, and also to a potion, the *elixir vite*, or elixir of life, supposed to confer immortality. It is still used for various popular remedies, for the most part composed of various aromatic and stimulative substances held in solution by alcohol.

**Elizabeth (Carmen Sylva)**, Dowager Queen of Roumania, born at Neuwied, principality of Wied, in 1843, died at Bucharest, 2nd March, 1916. In 1869 she was married to Prince Charles of Hohenzollern, who became King of Roumania in 1881. Queen Elizabeth, or, as she was generally known, Carmen Sylva (her pen-name), was not only a patron of Roumanian writers and artists, but herself a distinguished author. Among her works, which were all, with the exception of one, written in German, are: *The Bard of the Dimbovitza*, *Pilgrim Sorrow*, *A Real Queen's Fairy Tales*, and *From Memory's Shrine*. In 1914 she was made an honorary fellow of the Royal Society of Literature of Great Britain.

**Elizabeth**, Queen of England, daughter of Henry VIII and of Anne Boleyn, was born at Greenwich, 7th Sept., 1533, and almost immediately declared heiress to the crown. After her mother had been beheaded (1536) both she and her sister Mary were declared bastards and she was finally placed after Prince Edward and the Lady Mary in the order of succession. On the accession of Edward VI Elizabeth was committed to the care of the Queen-Dowager Catherine; and after the death of Catherine and execution of her consort Thomas Seymour she was closely watched at Hatfield, where she received a classical education under William Grindal and Roger Ascham. At the death of Edward Elizabeth vigorously supported the title of Mary against the pretensions of Lady Jane Grey, but continued throughout the whole reign an object of suspicion and surveillance. In self-defence she made every demonstration of zealous adherence to the Roman Catholic faith, but her inclinations were well known. On 17th Nov., 1558, Mary died, and Elizabeth was immediately recognized queen by Parliament. The accuracy of her judgment showed itself in her choice of advisers, Parker, a moderate divine (Archbishop of Canterbury 1559), aiding her in ecclesiastical policy; while William Cecil, Lord Burleigh, assisted her in foreign affairs.

The first great object of her reign was the settlement of religion, to effect which a Parliament was called on 23th Jan., and dissolved on the 8th May, its object having been accomplished.

The nation was prepared for a return to the Reformed faith, and the Parliament was at the bidding of the Court. The ecclesiastical system devised in her father's reign was re-established, the royal supremacy asserted, and the revised Prayer Book enforced by the Act of Uniformity. While, however, the formal establishment of the reformed religion was easily completed, the security and defence of the settlement was the main object of the policy and the chief source of all the struggles and contentions of her reign. Freed from the tyranny of Mary's reign, the Puritans began to claim predominance for their own dogmas, while the supporters of the Established Church were unwilling to grant them even liberty of worship. The Puritans, therefore, like the Catholics, became irreconcilable enemies of the existing order, and increasingly stringent measures were adopted against them. But the struggle against the Catholics was the more severe, chiefly because they were supported by foreign powers; so that while their religion was wholly prohibited, even exile was forbidden them, in order to prevent their intrigues abroad. Many Catholics, particularly priests, suffered death during this reign; but simple nonconformity, from whatever cause, was pursued with the severest penalties, and many more clergymen were driven out of the Church, by differences about the position of altars, the wearing of cups, and such like matters, than were forced to resign by the change from Rome to Reformation.

Elizabeth's first Parliament approached her on a subject which, next to religion, was the chief trouble of her reign, the succession to the Crown. They requested her to marry, but she declared her intention to live and die a virgin; and she consistently declined in the course of her life such suitors as the Duc d'Alençon, Prince Erik of Sweden, the Archduke Charles of Austria, and Philip of Spain. While, however, she felt that she could best maintain her power by remaining unmarried, she knew how to temporize with suitors for political ends, and showed the greatest jealousy of all pretenders to the English succession. With the unfortunate Mary, Queen of Scots, were connected many of the political events of Elizabeth's reign. On her accession the country was at war with France. Peace was easily concluded (1559); but the assumption by Francis and Mary of the royal arms and titles of England led to an immediate interference on the part of Elizabeth in the affairs of Scotland. She entered into a league with the Lords of the Congregation, or leaders of the Reformed party; and throughout her reign this party was frequently serviceable in furthering her policy. She also gave early support to the Huguenot party in France, and to the Protestants in the Netherlands, so that throughout Europe she was looked

on as the head of the Protestant party. This policy roused the implacable resentment of Philip, who strove in turn to excite the Catholics against her both in her own dominions and in Scotland. The detention of Mary in England (1568-87), whither she fled to the protection of Elizabeth, led to a series of conspiracies, beginning with that under the Earls of Northumberland and Westmorland, and ending with the plot of Babington, which finally determined Elizabeth to make away with her captive. The execution of Queen Mary (1587), though it has stained her name to posterity, tended to confirm her

During her reign the splendour of her government at home and abroad was sustained by such men as Burleigh, Bacon, Walsingham, and Throgmorton; but she had personal favourites of less merit who were often more brilliantly rewarded. Chief of these were Dudley, whom she created Earl of Leicester, and whom she was disposed to marry, and Essex, whose violent passions brought about his ruin. He was beheaded in 1601, but Elizabeth never forgave herself his death. Her own health soon after gave way, and she died on 24th March, 1603, naming James VI of Scotland as her successor.—BIBLIOGRAPHY:



Elizabethan Architecture. Moreton Old Hall, Cheshire

power among her contemporaries. The state of France consequent on the accession of Henry IV, who was assisted by Elizabeth, obviated any danger from the indignation which the deed had caused in that country; and the awe in which King James stood of Elizabeth and his dread of interfering with his own right of succession to England made him powerless. But Philip of Spain was not to be so appeased, the execution of Mary lending edge to other grievances. The fleets of Elizabeth had galled him in the West Indies, her arms and subsidies had helped to deprive him of the Netherlands; the Armada was already in preparation. Accordingly he called the Queen of England a murderess, and refused to be satisfied even with the sacrifice she seemed prepared to make of her Dutch allies. The Armada sailed on 29th May, 1588. The war with Spain dragged on till the close of Elizabeth's long reign.

M. A. S. Hume (editor), *Calendar of State Papers* (Spanish Series); J. Bruce (editor), *Letters of Elizabeth and James VI*; W. Camden, *History of Queen Elizabeth*; J. A. Froude, *History of England*; M. Creighton, *Queen Elizabeth*; E. S. Beesley, *Queen Elizabeth*.

Elizabeth, a city of New Jersey, United States, 14 miles s.w. of New York, with which it has ample communication by railway and steamer. It is a favourite residence of New York business men. The Singer Sewing-machine Company has a large factory here, and there are also foundries and oil-cloth factories. Pop. 73,400.

Elizabeth, St., of Thuringia, daughter of Andreas II, King of Hungary, was born at Pressburg 1207, and in 1221 married to Louis IV, landgrave of Thuringia. She erected hospitals, fed a multitude of poor from her own table, and wandered about in a humble dress, relieving the wretched. Louis died on a crusade, and her own

life terminated 19th Nov., 1281, in a hospital which she had herself established. The church over her tomb at Marburg is one of the most splendid Gothic edifices in Germany.

**Elizabethan Architecture**, a style of architecture which prevailed in England during the reigns of Elizabeth and James I. It succeeded to the Tudor style, properly so called, with which it is sometimes confounded. The Elizabethan is a mixture of inferior Gothic and debased

has sometimes been called the English Renaissance. The epithet Jacobean has sometimes been given to the very latest stage of the Elizabethan, differing from the Elizabethan proper in showing a greater admixture of debased Italian forms. The princely houses which arose during the reign of Elizabeth are numerous, and many even yet remain to attest the splendour of the time. Of these may be mentioned Burghley House, Hardwick Hall, and Bramhall Hall.—Cf. Gotch and Brown, *Architecture of the Renaissance in England*.

**Elizabeth Farnese** (fär-nä'zä), Queen of Spain, daughter of Edward II, Prince of Parma, born 1692, died in 1776. On becoming the second wife of Philip V she surprised those who had counselled the marriage by assuming the practical headship of the kingdom, and her ambition and that of her minister Alberoni disturbed the whole of Europe. Carlyle calls her a "terragrant tenacious woman".

**Elizabethgrad**, a town of the Ukraine, on the Ingul, with an imperial palace, a theatre, manufactures of soap and candles, and several great fairs. Pop. 75,800.

**Elizabeth Islands**, a group of sixteen American islands south of Cape Cod, with a permanent population of about 150.

**Elizabeth of Valois**, or **Isabella**, Queen of Spain, was born in 1545, died in 1568. She was the daughter of Henry II of France and Catherine de' Medici. By the Treaty of Cateau-Cambrésis she was destined to be the wife of the Infante, Don Carlos, but his father, Philip II, being left a widower, became fascinated and married her himself. The stories of a romantic relationship existing between Elizabeth and Don Carlos are entirely groundless, but have furnished tragic subjects to Otway, Campistron, Chénier, Schiller, and Alfieri.

**Elizabeth Petrovna**, Empress of Russia, daughter of Peter the Great and Catherine, born in 1709 or 1710, died in 1762. She ascended the throne on 7th Dec., 1741, as the result of a conspiracy, in which Ivan VI, a minor, was deposed. Elizabeth is said to have rivalled her mother in beauty, and to have surpassed her in her love of pleasure, and her government was largely conducted by favourites. She was a patron of literature, founded the University of Moscow, and corresponded with Voltaire. A war with Sweden, in 1743, was advantageously concluded by the peace of Åbo. In 1748 she sent an army to assist Maria Theresa in the War of the Succession, and joined in the Seven Years' War against Prussia. She died before this war was concluded.—**BIBLIOGRAPHY:** Nisbet Bain, *The Daughter of Peter the Great*; A. S. Rappoport, *The Fair Ladies of the Winter Palace*.

**Elizabethpol**, a town of Russia, in the Cau-



Elizabethan Architecture: an Interior  
Reconstruction in the Victoria and Albert Museum,  
London

It has, producing a singular heterogeneousness in detail, with, however, wonderful picturesqueness in general effect, and domestic accommodation more in accordance with the wants of an advancing civilization than was afforded by the styles which preceded it. The chief characteristics of Elizabethan architecture are: windows of great size both in the plane of the wall and deeply embayed, ceilings very richly decorated in relief, galleries of great length, very tall and highly-decorated chimneys, as well as a profuse use of ornamental strapwork in the parapets, window-heads, &c. The Elizabethan style is the last stage of the Tudor or Perpendicular, and from its corresponding in point of period with the Renaissance of the Continent

casus, capital of the government of same name, covering a great space of ground from the gardens and open areas it contains, but very unhealthy. Pop. 18,503.—The government has an area of 17,000 sq. miles, a pop. of 636,316. It is partly mountainous, partly steppes, and produces grain, cotton, tobacco, and wine.

**Elizabeth Stuart**, Queen of Bohemia, daughter of James I of England and VI of Scotland, born in Falkland Palace, Fifeshire, 1596, died on 13th Feb., 1602. Her marriage with the Palatine Frederick was celebrated at Whitehall in 1613. Her husband, then at the head of the Protestant interest in Germany, accepted in 1619 the Crown of Bohemia offered to him by the revolted Protestants of that country. After his defeat, however, by the imperialists at the battle of Prague in 1620, he and his wife were obliged to flee, first to Breslau and Berlin, and then to the Hague. Elizabeth returned to England at the Restoration with her nephew Charles II, but mingled very little in society. Elizabeth had thirteen children, of whom Charles Louis, the eldest surviving, was reinstated in the Palatinate by the Treaty of Westphalia in 1648. By her daughters, Elizabeth Charlotte and Sophia, she was the ancestress of Louis Philippe and of George I, and her sons, Rupert and Maurice, became famous Cavalier leaders.

**Elk, Moose, or Moose Deer** (*Alces Machlis*), the largest of the deer family, a native of Northern Europe, Asia, and America. The American form (to which the name moose is usually given) is sometimes separated from the European as *Alces americanus*, but most naturalists find no

almost from the base into a broad palmate form with numerous anags. In colour the elk is greyish brown, the limbs, sides of head, and coarse mane being, however, of a lighter hue. Its flesh resembles beef rather than venison. For the most part elks are inoffensive, and so exceedingly wary that they are approached only with difficulty. In America the Indians and half-breeds are the most skilful moose-hunters. By trampling down a restricted area of ground (moose-yard) and browsing on the edge of this, the moose is able to protect itself efficiently against the attacks of wolves. The moose has a wide range in Canada, extending from the Arctic Ocean and British Columbia to New Brunswick and Nova Scotia; and it is found also in Maine. It feeds largely on the shoots of trees or shrubs, such as the willow and maple, and on bark, &c. In Sweden its destruction is illegal, and in Norway there are many restrictions upon the hunting of it.

**Elk, Irish** (*Megaceros hibernicus*, or *Cervus giganteus*), a large deer found in the Pleistocene



Antlers and Skull of Irish Elk



Elk (*Alces Machlis*)

specific difference between them. The elk or moose has a short compact body, standing about 6 feet in height at the shoulders, a thick neck, large clumsy head, and horns which flatten out

strata, and distinguished by its enormous antlers, the tips of which are sometimes 11 feet apart. Though a true deer, its antlers differ from those of living species in that the beam is flattened into a palm. To sustain the great weight, unusually large and strong limbs and neck vertebrae were required. Its remains are found not only in Ireland but in Scotland and England, and on the Continent, where they occur in bogs, lacustrine deposits, brick-clay, and ossiferous caves.

**El Khargeh.** See *Khargeh*.

**Elkhart**, a town of Indiana, United States, on Elkhart River, with railroad works and paper-mills. Pop. 19,282.

**Ell** (Lat. *ulna*, Gr. *ōlenē*, forearm), an old measure whereby cloths, stuffs, &c., are sometimes measured. The ell English is 5 quarters (45 inches), the ell Flemish 3 quarters (27 inches). In Scotland an ell contained 37·2 inches English.

**Ell'and**, a town of England, W. Riding of Yorkshire, between Halifax and Huddersfield, with an old church and town-hall, manufactures of cottons and woollens, and quarries. It gives its name to a parliamentary division. Pop. 10,676.

**Ellenborough**, Edward Law, Lord, English lawyer, Lord Chief Justice of the King's Bench, born in 1750 at Great Salkeld, Cumberland, died in 1818. He was educated at the Charterhouse and at Peterhouse, Cambridge, and called to the Bar in 1780. Not long afterwards he took silk, and at the trial of Warren Hastings, in 1783, acted as leading counsel. The defence did not come on until the fifth year of the trial, but after eight years Hastings was acquitted and Law's success assured. In 1801 he was made Attorney-General, and in 1802 became Lord Chief Justice of the King's Bench, and was created baron. He held the office of Chief Justice for fifteen years, resigning in 1818.

**Ellenborough**, Edward Law, first Earl of, son of Lord Chief Justice Ellenborough (see above), born in 1700, died in 1871. He was educated at Eton and St. John's College, Cambridge, and in 1818, having succeeded his father as second baron, he entered the House of Lords. In 1818 he took office as Lord Privy Seal, and was President of the Board of Control from 1828-30, and again in 1834. In 1841 he accepted the governor-generalship of India, and arrived in Calcutta in 1842, in time to bring the Afghan War to a successful issue. The annexation of Scinde in 1843 was followed by the conquest of Gwalior, but the conduct of the Governor-General gave dissatisfaction at home, and he was recalled early in 1844. On his return, however, he was defended by Wellington, and received the thanks of Parliament, an earldom, and the Grand Cross of the Bath. He then held the post of First Lord of the Admiralty (1845-6), and was President of the Board of Control from Feb. to June, 1858. His dispatch censuring the policy of Lord Canning as Governor-General of India led to his resignation, and he never resumed office.

**Ell'ice Islands**, or **Lagoon Islands**, a group of coral islands annexed to Britain in 1892, lying north of Fiji, and extending for 360 miles north-west to south-east. The islands were discovered by Maurelle in 1781. The inhabitants are of Samoan race and language, have long been Christians, and support themselves chiefly by the coco-nut. Pop. 3084.

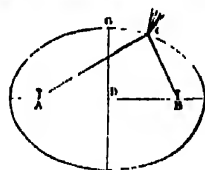
**Ellichpur** (el-ich-pôr'), a town of India, in Ellichpur district, Berar, once a large and prosperous town. There is a military cantonment within two miles. Pop. 27,500.

**Ellicott**, Right Rev. Charles John, English divine, born 1819, died in 1905. Educated at

Cambridge, he was professor of divinity in King's College, London, Hulsean lecturer and Hulsean professor of divinity at Cambridge, and Dean of Exeter, and in 1863 was appointed Bishop of Gloucester and Bristol. He was for eleven years chairman of the scholars engaged on the revision of the New Testament translation, and published commentaries on the Old and the New Testaments, as well as sermons, addresses, and lectures.

**Elliott**, Ebenezer, English poet, known as the 'Corn-law Rhymers', born in 1781 near Rotherham, Yorkshire, died in 1840. At the age of seventeen he published his first poem, *The Vernal Walk*, which was soon followed by others. In 1820 *The Village Patriarch*, the best of Elliott's longer pieces, was published. From 1831 to 1837 he carried on business as an iron merchant in Sheffield. His *Corn-law Rhymes*, periodically contributed to a local paper devoted to the repeal of these laws, attracted attention, and were afterwards collected and published with a longer poem entitled *The Ramier*. Commercial losses compelled him in 1837 to contract his business, and in 1841 he retired from it altogether. In 1850 two posthumous volumes appeared, entitled *More Prose and Verse by the Corn-law Rhymers*.

**Ellipse**, one of the conic sections. The curve generated by a point which moves so that its distance from a fixed point bears a constant ratio (less than unity) to its distance from a fixed straight line. Kepler discovered that the paths described by the planets in their revolutions round the sun are ellipses, the sun being placed in one of the foci. To describe an ellipse: At a given distance on the surface on which the ellipse is to be described fix two pins, A and B, and pass a looped string round them. Keep the string stretched by a pencil, C, and move the pencil round, keeping the string at the same tension, then the ellipse *exactly* will be described. A and B are the *foci*, O the centre, FF the major axis, GG the minor axis, and the fraction OA/OF the *eccentricity* of the ellipse. A line drawn from any point in the curve perpendicularly to the axis is an ordinate to the axis. Any straight line drawn through the centre and terminated both ways by the curve is called a diameter.



Ellipse

**Ellipsoid**, a surface bearing the same sort of relation to a spherical surface as an ellipse bears to a circle. The name is also given to the solid bounded by such a surface.

The equation of an ellipsoid, referred to its principal axes, is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$$

Here  $a, b, c$ , are the lengths of the principal semi-axes. A plane section is an ellipse, but there are two particular directions of the section for which the ellipse reduces to a circle.

The ellipsoid has important applications in dynamics, as a means of interpreting algebraic formulæ for physical quantities; examples are the ellipsoids of strain and of gyration, and Poinso't's momental ellipsoid.

Two ellipsoids in which the principal sections lie in the same planes, and have the same foci, are called *confocal*.

*Ellipsoidal Harmonics* are mathematical functions by means of which certain physical problems in heat and electricity relating to ellipsoidal surfaces can be solved. For ellipsoids of revolution, see *Spheroid*.

Elliptic Functions are generalizations of the circular functions *sine*, *cosine*, &c. If

$$x = \int_0^x \frac{dx}{\sqrt{(1-x^2)}} = \sin^{-1}x,$$

we have  $x = \sin u$ . Similarly, if

$$u = \int_0^x \frac{dx}{\sqrt{(1-x^2)(1-k^2x^2)}},$$

we may write  $x = \sin u$ ,  $\sqrt{1-k^2x^2} = \cos u$ ,  $\sqrt{1-k^2x^2} du = dx$ . These are Jacobi's elliptic functions. They obviously reduce to  $\sin u$ ,  $\cos u$ , 1, when  $k$  is 0. The circular functions have the period  $2\pi$ ; the elliptic functions are *doubly* periodic, having both a real and a pure imaginary period when  $k^2$  is real and less than 1. Like the functions *sine* and *cosine*, the elliptic functions have *addition theorems*, e.g.

$$\operatorname{sn}(u+v) = \frac{\operatorname{sn} u \operatorname{cn} v \operatorname{dn} v + \operatorname{sn} v \operatorname{cn} u \operatorname{dn} u}{1 - k^2 \operatorname{sn}^2 u \operatorname{sn}^2 v}.$$

Another method and notation has been introduced by Weierstrass, and is now much used. The functions are needed for the solution of many physical problems, such as those of the motion of a top and of a pendulum.—BIBLIOGRAPHY: A. G. Greenhill, *Elliptic Functions*; Appell and Lacour, *Fonctions Elliptiques*; Whitaker and Watson, *Modern Analysis*.

Ellis, Alexander John, English philologist, born 1814 (name originally Sharpe), died in 1890. He was a distinguished graduate of Trinity College, Cambridge, was elected to the Royal

Society in 1864, and was long a prominent member of the Philological Society, being more than once its president. Though phonetics was the subject in which he most highly distinguished himself, he was equally at home in mathematical and musical subjects. His chief published work is *Early English Pronunciation* (in five parts), between 1869 and 1889; but his publications in the form of books, pamphlets, papers, and articles on phonetics, music, and mathematics are numerous.

Ellis, George, English man of letters, born in 1753, died in 1815. Educated at Westminster School and Trinity College, Cambridge, he became one of the junta of wits concerned in the well-known political satire, *The Reclliad*, and contributed to the *Anti-Jacobin*. He also wrote a preface, notes, and appendix to Way's translation of Le Grand's *Fabliaux*, and published *Specimens of the Early English Poets, with an Historical Sketch* (1790), and *Specimens of Early English Metrical Romances* (1805). He was an intimate friend of Sir Walter Scott.

Ellis, William, English missionary, born 1794, died 1872. He was sent out to the South Sea Islands in 1816 by the London Missionary Society, and returned in 1825, one result of his labours being *Polynesian Researches* (1829). From 1830 to 1844 he was secretary to the society, and afterwards on its behalf made several visits to Madagascar, the longest being from 1861 to 1865. These visits led him to publish *Three Visits to Madagascar* (1858), *Madagascar Revisited* (1867), and the *Martyr Church of Madagascar* (1870).

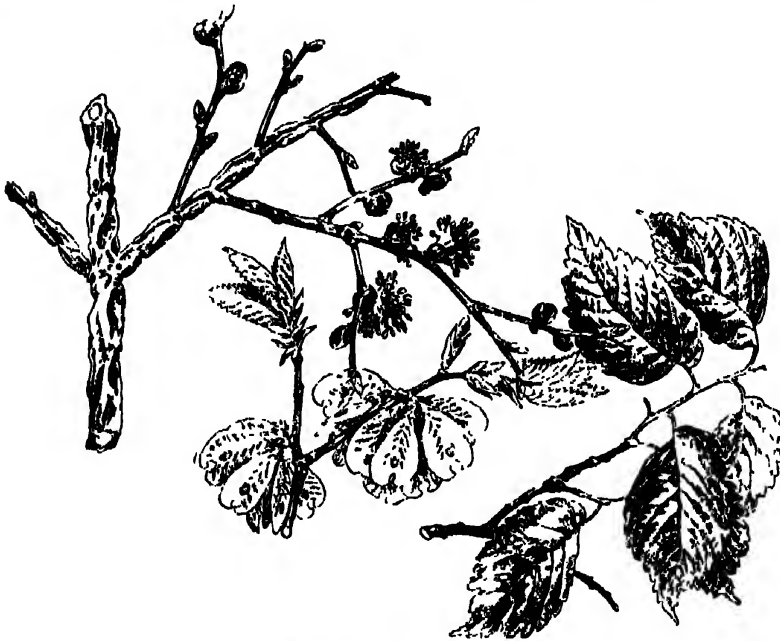
Ellis Island, a small island in the upper New York Bay. Sold by the New York State to the United States, in 1808, it was for a long time used as a powder magazine, but in 1891 was made an immigrant station.

Ello'ra, or Elo'ra, a ruined village, Hindustan, Deccan, Nizam's Dominions, 13 miles north-west of Aurangabad, famous for its rock and cave temples excavated in the crescent-shaped scarp of a large plateau. They run from north to south for about a mile and a quarter, and consist of five Jain caves towards the north, seventeen Brahminical caves at the centre, and towards the south twelve Buddhistic caves. Of the temples some are cut down through the rock, and left open above like isolated buildings, others are excavated under the hill in the manner of caves properly so called. The interior walls are often richly carved with mythological designs. The most magnificent of the whole is the Hindu temple called Kailasa or Cailasa, the central portion of which forms an isolated excavated mass or immense block 500 feet in circumference and 100 feet high. It is surrounded by galleries or colonnades at the distance of 150 feet, in which



the whole Hindu pantheon is cut in the perpendicular rock. Another fine temple, much smaller, but cut under the hill, is the Buddhist cave of Visvakarma, the only one excavated with a curved roof. The date of the caves is not certainly known, but they were probably the work of the reigning families at the neighbouring Deoghiri, now Daulatabad, which, prior to the Mohammedan conquest, A.D. 1293, was the capital of a powerful Hindu principality.—Cf. Fergusson and Burgess, *The Cave Temples of India*.

Elm, a genus of trees (*Ulmus*; nat. ord., *Ulmaceæ*), consisting of eighteen species, natives of the northern temperate zone and mountains of Tropical Asia. They have bisexual flowers with a campanulate calyx, as many stamens as there are divisions in the limb of the calyx, and two styles. Two species are common in Britain, *Ulmus campestris* and *Ulmus montana*, with many varieties. The *Ulmus campestris*, or common elm, is a fine tree, of rapid and erect growth, and yielding a tall stem, remarkable for the uni-



Common Elm (*Ulmus campestris*)

Fruit, flowers, and leaves

Ellore, a town of India, Godavari district, Madras presidency, once the capital of the Northern Circars. Pop. 29,500.

Ellwood, Thomas, an early writer among the Quakers, born in 1639, died in 1713. About 1690 he was induced to join the Society of Friends, and soon after published *An Alarm to the Priests*. He was imprisoned on account of his religion, but subsequently became reader to Milton, and upon reading the MS. of *Paradise Lost* is said to have suggested to the poet the idea of writing the *Paradise Regained*. In 1705 and 1709 he published the two parts of his *Sacred History*. His works include a poetical life of King David, the *Davidists*, *Forgery no Christianity*, and an autobiography, *The History of the Life of Thomas Ellwood*; written by his own hand.

formity of its diameter throughout. It is very common as a timber tree in England; but as it rarely produces seed it is questionable whether it is indigenous. It is a native of the south and middle of Europe, and the west of Asia. The average height of a mature tree is 70 or 80 feet, but some reach a height of 150 feet. The wood is brown, hard, of fine grain, not apt to crack, and is used for many purposes. The tree generally attains maturity in seventy or eighty years. *Ulmus montana* (the mountain or wych elm), a native of Scotland, grows to a less height than the English elm, is of slower growth, and yields a much shorter bole, but it is far bolder in its ramification and more hardy. It usually attains to the height of about 50 feet. It does not produce suckers, like the English elm, but yields

seed freely. The timber is strong and elastic, and the tree often yields large protuberances of gnarled wood, finely knotted and veined, and much esteemed for veneering. *Ulmus glabra*, the smooth-leaved elm, is a variety common in some parts of Britain. It first appeared about the middle of the eighteenth century. The most ornamental tree of the genus is *Ulmus montana*, variety *pendula*, the weeping elm. The American or white elm (*Ulmus americana*) is abundant in the Western States, attaining its loftiest stature between lat. 42° and 46°; here it reaches the height of 100 feet, with a trunk 4 or 5 feet in diameter, rising sometimes 60 or 70 feet before it separates into a few primary limbs. Its wood is not much esteemed. The red or slippery elm (*Ulmus fulva*) is found throughout a great extent of country in Canada, Missouri, and as far south as lat. 31°; it attains the height of 50 or 60 feet, with a trunk 15 or 20 inches in diameter; the wood is of better quality than that of the white elm. The leaves and bark yield an abundant mucilage. The wahoo (*Ulmus alata*), inhabiting from lat. 37° to Florida, Louisiana, and Arkansas, is a small tree, 30 feet high. The branches are furnished on two opposite sides with wings of cork 2 or 3 lines wide; the wood is blue-grained and heavy.

Elmi'na, a British town and seaport on the west coast of Africa, 8 miles west of Cape Coast Castle. It was acquired by Britain in 1872 with the other Dutch possessions on the Gold Coast, when it was claimed by the King of Ashanti, the result being the Ashanti Wars of 1873-4. Pop. 12,500.

Elmi'ra, a town of the United States, N. York, on the Chemung River; with a college for women, founded in 1855, the State reformatory, and a fine court-house. Its industrial establishments comprise rolling-mill, blast-furnace, foundries, and machine-works. Pop. 37,170.

Elmo's Fire, St., a meteoric appearance often seen playing about the masts and rigging of ships. If two flames are visible (Castor and Pollux) the sailors consider it a good omen; if only one (Helena), they regard it as a bad one. The name is derived from St. Elmo, or St. Erasmus, who was broken on the wheel A.D. 304.

Elmshorn, a town in Schleswig-Holstein, 20 miles north-west of Hamburg, on the Krückau, a navigable stream. Pop. 14,790.

Elmsley, Peter, D.D., English scholar, born in 1773, died in 1825. Educated at Oxford, he was one of the original contributors to the *Edinburgh Review*, and wrote occasionally, at a subsequent period, in the *Quarterly*. He finally settled at Oxford, on obtaining the headship of St. Alban's Hall and the Camden professorship of ancient history in 1823. He published editions of the *Œdipus Tyrannus* (1811), *Hierarchiæ* (1815),

*Medea* (1818), *Bacchæ* (1821), and *Œdipus Coloneus* (1823).

El Obeld. See *Obeid*.

Elodea, a genus of submerged water-plants, nat. ord. Hydrocharitaceæ. *E. canadensis*, the Canadian water-weed, was accidentally introduced into Britain about 1840, and spread throughout Europe with extraordinary rapidity, and entirely by vegetative reproduction, as only the ♀ plant exists on this side of the Atlantic. The plant is much used for physiological experiments, e.g. for showing the movements of protoplasm.

Elo'him (plural of *Eloah*), one of the Hebrew names for God, of frequent occurrence in the Bible. Elohim is used in speaking both of the true God and of false gods, while Jehovah is confined to the true God. The plural form of Elohim has caused a good deal of controversy, some considering it as containing an allusion to the doctrine of the Trinity, others regarding it as the plural of excellence, others holding it as establishing the fact of a primitive polytheism. The Elohist passages in the *Pentateuch*, or, in other words, the passages in which the Almighty is always spoken of as Elohim, are supposed to have been written at an earlier period than those in which he is spoken of as Jehovah. The Elohist passages are simpler and more primitive in character than the Jehovistic; thus *Gen. i*, 27 is Elohist; *Gen. ii*, 21-4 is Jehovistic.

El Paso ('the pass' or crossing), a town of the United States, in Texas, at an important ford or crossing of the Rio Grande del Norte, where there is now a railway bridge, with extensive railway connections and large trade with Mexico, the smaller Mexican town of same name being on the opposite bank of the river. Pop. (including suburbs), 39,280.

Elphinstone, Hon. Mountstuart, Indian administrator, son of the eleventh Lord Elphinstone, born in Scotland in 1778, died in 1859. He joined the Bengal Civil Service in 1795, was Ambassador to the Afghan Court in 1808, Resident at the Court of Poona in 1810 to 1817, and British commissioner to that province from 1817 to 1819, when he became Governor of Bombay. During a government of seven years he established a code of laws, lightened taxes, and paid great attention to schools and public institutions. He resigned in 1827. A college established by the natives was called after him Elphinstone College. He was the author of an *Account of the Kingdom of Cabul and its Dependencies* (1815), and a *History of India* (1811). He was offered the governor-generalship of India in 1835, and afterwards that of Canada, both of which he declined.

Elphinstone, William, a Scottish prelate, founder of King's College and University, Aber-

deen, born at Glasgow in 1481, died in 1514. He was educated at Glasgow College, and served four years as priest of St. Michael's in that city. He then went to France and became professor of law, first at Paris and subsequently at Orleans, but before 1474 he returned home at the request of Muirhead, Bishop of Glasgow, who made him commissary of the diocese. In 1478 he was made commissary of the Lothians, and in 1470 Archdeacon of Argyle. Soon after he was made Bishop of Ross; and in 1483 was transferred to the see of Aberdeen. In 1484 and 1486 he was commissioned to negotiate truces with England, and in 1488 was Lord High-Chancellor of the kingdom for several months. He was next sent on a mission to Germany, and after his return held the office of Lord Privy Seal till his death in 1514. In 1494 he obtained a papal bull for the erection of the university of King's College at Aberdeen.

**Elsinore'** (Dan. *Helsingör*), a seaport of Denmark, in the Island of Seeland, at the narrowest part of the Sound, here only  $3\frac{1}{2}$  miles broad, 24 miles north by east of Copenhagen, opposite Helsingborg in Sweden, and connected with it by train-ferry. Near Elsinore is the castle of Kronborg, built by Frederick II of Denmark about 1580, and commanding the Sound. The castle, now chiefly used as barracks, is associated with Shakespeare's *Hamlet*. Before the abolition of the Sound dues in 1857 all merchant ships passing through were bound to pay toll here. Pop. 13,990.

**Elster**, two German rivers, the White or Great Elster, a tributary of the Saale; the Black Elster, a tributary of the Elbe.

**Elswick** (els'ik), a suburb of Newcastle, England, containing the great ordnance-works of Armstrong, Mitchell, & Co. Pop. 58,372.

**Elton**, Charles Isaac, English jurist and archaeologist, born 1839, died 1900. He was educated at Cheltenham and Oxford, became a barrister and a member of Parliament, and wrote various works on legal and other subjects, the most important being *Origins of English History*. In this work he traces the development of England and its inhabitants, from the earliest times regarding which we have any knowledge, to the acceptance of Christianity by the Anglo-Saxons, the investigation of the evidence furnished by Greek and Roman writers, and the discussion of prehistoric ethnology and archaeology being especially thorough. Other works are: *Commons and Waste Lands*, and *W. Shakespeare: His Family and Friends*.

**Elutriation** (Lat. *elutriare*, to wash out), the process of separating the finer particles of a clay, earth, or similar mass, from the coarser, consisting in stirring up the substance in water, letting the coarser particles subside, running off the liquid

containing the finer particles, and then waiting till they subside.

**Elyas**, a fortified city of Portugal, province of Alentejo, near the Spanish frontier, 12 miles north-west of Badajoz, on a height flanked by two others, each crowned by a castle. It has a cathedral, partly Moorish and partly Gothic, and a Moorish aqueduct, a magnificent work which brings water from a distance of 15 miles. Pop. 10,855.

**Ely** (ē'li), an episcopal city of England, in the county of Cambridge, on an eminence on the left bank of the Ouse. The ecclesiastical structures comprise the cathedral, one of the largest in England, and the churches of St. Mary, and the Holy Trinity, the last belonging to the time of Edward II, and one of the most perfect buildings of that age. The superb cathedral occupies the site of a monastery founded about the year 678 by Etheldreda, daughter of the King of East Anglia. Its entire length, east to west, is 517 feet, and its west tower is 270 feet high. The whole structure comprises an almost unbroken series of the various styles of architecture which prevailed in England from the Conquest to the Reformation, yet with no loss of impressiveness as a whole. It was begun in 1083, completed in 1534, and since 1847 has undergone extensive additions and restoration. A fine gateway, built in the reign of Richard II, forms the principal entrance to the cathedral precincts. There are a few manufactures, but most of the inhabitants are engaged in agricultural labour. Pop. 7917.

**Ely, Isle of**, a portion of the county of Cambridge, separated by the Ouse from the rest of the county, and forming itself a sort of county. It is about 28 miles long by 25 miles broad; area, 230,250 acres. The name is also given to a smaller tract, about 7 miles long by 4 miles broad. The soil is very fertile. Pop. 69,752.

**Elymus**, a genus of grasses, natives chiefly of the north temperate zone. The British species, *E. arenarius* (lyme grass) is a good sand-binder.

**Elys'ium**, or **Elysian Fields**, among the Greeks and Romans the regions inhabited by the blessed after death. They are placed by Homer at the extremities of the earth, by Plato at the antipodes, and by others in the Fortunate Islands (the Canaries). They were at last supposed to be in the interior of the earth, where Virgil described them as being. The happiness of the blessed consisted in a life of tranquil enjoyment in a perfect summer land, where the heroes, freed from all care and infirmities, renewed their favourite sports.

**Ely'tra**, the horny cases into which the front wings of beetles are modified, and which meet in a straight line down the middle of the back. The membranous hind-wings are here the organs of flight, and when not in use are

folded longitudinally and transversely, and tucked away under the elytra.

**Elze** (el'tse), Karl, German writer, distinguished for his studies in English literature, born 1821, died 1889. He studied in Leipzig and Berlin, was long a teacher in the gymnasium of his birth-place, Dessau, and in 1875 was appointed to the chair of English language and literature at Halle. Among his writings were valuable biographies of Sir Walter Scott and Lord Byron (the latter translated into English), and a biographical and critical work on Shakespeare, also translated into English (1888).

**El'zevir**, or **Elzevier**, the name of a family of publishers and printers, residing at Amsterdam and Leyden, celebrated for the beauty of the editions of various works published by them, principally between 1595 and 1680. Louis, the founder of the family (born 1540, died 1617), settled in Leyden, and between 1583 and his death produced about 150 works. Five of his seven sons followed his business:—Matthæus at Leyden; Louis (II) at the Hague; Gilles at the Hague and afterwards at Leyden; Joost in Utrecht; and Bonaventure, who in 1626 associated himself with Abraham, the son of Matthæus. From the press of Abraham and Bonaventure issued the exquisite editions of the classics which have made the name of Elzevir famous. Of these the *Livy* and *Tacitus* of 1634, the *Pliny* of 1635, the *Virgil* of 1636, and the *Cicero* of 1642 are perhaps the most beautiful. The Elzevir books are distinguished by the types and the choice of the paper rather than by the critical preparation of their texts.

**Emanation**, in a specific sense, an idea at the centre of many philosophic systems which seek to explain the universe as an eternal efflux or emanation from the Supreme Being, comparable with the efflux of light from the sun. The idea of emanation came from the East, and traces of the doctrine are found in the system of Zoroaster. It had a powerful influence on the ancient Egyptian philosophy, as also on that of the Greeks, as may be seen in Pythagoras. It was subsequently developed by Plotinus, the Gnostics, Manicheans, Pantheists, and other sects.

**Eman'uel the Great**, King of Portugal, born in 1469, died in 1521. He ascended the throne in 1495, and during his reign were performed the voyages of discovery of Vasco da Gama, of Cabral, of Americus Vesputius, and the heroic exploits of Albuquerque, by whose exertions a passage was found to the East Indies, the Portuguese dominion in Goa was established, and the Brazils and Moluccas were discovered. The commerce of Portugal, under Emanuel, was more prosperous than at any former period. The treasures of America flowed into Lisbon, and the reign of Emanuel was justly called 'the golden

age of Portugal'. He died at the age of fifty-two, deeply lamented by his subjects, but hated by the Moors and the Jews, whom he had expelled from the country. He was a patron of learned men, and himself left memoirs on the Indies. He married three times: in 1497 Isabella, daughter of Ferdinand and Isabella, heiress of Castile; in 1500 her sister Maria; and in 1519 Eleonora of Austria, sister of Charles V.

**Embalming** (em-ban'ing; Gr. *balsamon*, balm), the process of so treating dead bodies with aromatic and antiseptic substances as to preserve them from corruption and decomposition. The ancient Egyptians employed this art on a great scale, embalming not only human corpses, but also the bodies of cats, ibises, crocodiles, and other animals held sacred. The mummy of King Mer-en-ré, who lived about 2500 years before our era, found in 1880, was in an excellent state of preservation. Other peoples, such as the Assyrians and Persians, also followed the practice, though hardly equalling Egyptian methods. The abdomen was emptied through an incision, and the brains drawn through the nostrils by means of a special instrument. The ancient Peruvians appear to have injected and washed the corpses with a fluid that flows from imperfectly burned wood, in which pyroligneous acid, creosote, and other antiseptics are present. Pliny alludes to the use of a similar fluid by the Egyptians. In more recent times bodies have been preserved for centuries by embalming, especially when they have remained at a low and uniform temperature and have been protected from the air. The corpse of Edward I, buried in Westminster Abbey in 1307, was found entire in 1770. Canute died in 1036, and his body was discovered very fresh in Winchester Cathedral in 1770. The bodies of William the Conqueror and of his wife Matilda were found entire at Caen in the sixteenth century. Of the various modern artificial means of preserving bodies, impregnation with corrosive sublimate appears to be one of the most effective, next to immersion in spirits. An injection of sulphate of zinc into the blood-vessels is also stated to be satisfactory; while natron, various spices, and other aromatic compounds are sometimes employed. The original reason for embalming was most probably the preservation of the body to await a resurrection and a future life.—BIBLIOGRAPHY: W. Budge, *The Mummy*; G. Elliot Smith, *A Contribution to the Study of Mummification in Egypt*; Myers, *Textbook of Embalming*.

**Embank'ment**, a mound of earth, &c., thrown up either for the purpose of forming a roadway at a level different from that of the natural surface of the ground, or for keeping a large body of water within certain limits. When con-

structed wholly of earth or clay, it is triangular in cross-section, with the apex cut off parallel to the base line, the angle of the sloping sides varying with the nature of the material used. Thus the slope of loose rubble, chalk, stone, loamy sand, or gravel requires about 1½ base to 1 vertical; dry, loose, and ordinary clay, 2 horizontal to 1 vertical, while some clays require a much wider base. To prevent subsidence on marshy or peaty soils, either the weight of the heart of the embankment is diminished, as in Holland, by introducing layers of reeds or fascines, or artificial foundations are prepared. The embankment may be prevented from slipping laterally by forming steps in the earth of the subsoil, or by cutting deep trenches at the feet of the slopes. In cases where embankments are raised for the storage of water, a 'puddle-dike', that is, a water-tight wall, must be inserted through the whole depth of the bank down to the impermeable strata beneath. To resist the action of wind and rain, or of the waters of a slow-flowing stream, the banks should in all possible cases be covered with turf. Among the largest embankments hitherto executed are those on the banks of the Po, the Meuse, the Scheldt; on the shores of the Netherlands; the Oberhäuser embankment on the Augsburg and Lindau Railway, the Gadelbach cutting on the Ulm and Augsburg line, and the Tring cutting on the London and North-Western Railway.

**Embar'go**, in commerce, an arrest on ships or merchandise by public authority; or a prohibition of State, commonly on foreign ships, in time of war, to prevent their going out of or coming into port. A breach of embargo, under knowledge of the insured, discharges the underwriters of all liability.

**Em'bassy**, in its strict sense, signifies a mission presided over by an ambassador, as distinguished from a legation or mission entrusted to an envoy. An ambassador, as the representative of the person of his sovereign, can demand a private audience of the sovereign to whom he is accredited, while an envoy must communicate with the Minister for Foreign Affairs.

**Ember-days**, in the Anglican and Roman Catholic Churches, fast-days occurring at the times in the year appointed for ordinations. As now observed they are the Wednesday, Friday, and Saturday after the first Sunday in Lent, after the feast of Pentecost or Whitsunday, after the festival of the Holy Cross (14th Sept.), and after the festival of St. Lucia (13th Dec.). The weeks in which these days fall are called *Ember-weeks*.

**Ember-goose** (*Colymbus septentrionalis*), an aquatic bird, known also as the great northern diver and loon. The latter name, however, is also applied to the great crested grebe.

**Emberizi'dæ**, a family of small perching birds, typical genus *Emberiza*. It includes the buntings, the snow-flake, the yellow-hammer, and reed sparrow. The ortolan belongs to this family. By some naturalists it is classified as a sub-family of the finches.

**Embez'ziement** is the appropriation, by a clerk or servant, to himself, of money or property put into his hands in trust. In English law it is a felony punishable by penal servitude for not more than fourteen years, or by imprisonment; and in the case of a male under the age of sixteen, by whipping in addition to the imprisonment.

**Em'blements** (Fr. *emblaver*, to sow with grain), in law, the crops actually growing at any time upon land. They are considered in law as personal property, and pass as such to the executor or administrator of the occupier, if the latter die before he has actually cut, or reaped, or gathered the same.

**Em'bolism** is the obstruction of a blood-vessel by an embolus, the name given to a blood-clot or other body carried by the blood-stream, and obstructing the circulation at the point of lodgment. An embolism in a vital organ gives rise to serious symptoms which may cause death in a short time, or more remotely by the production of gangrene or pyæmia.

**Embos'sing**, the art of producing raised figures upon plane surfaces, such as on leather for bookbinding; on paper for envelopes; on wood or bronze, in architecture or sculpture. Embossing in needlework is effected by embroidery over figures padded with wool felt.

**Embra'cery**, an attempt to corrupt or influence a jury by money, promises, letters, entertainments, persuasions, or the like.

**Embra'sure**, in fortification, an opening in the breastwork or parapet of a battery or fortress, to admit of a gun being fired through it.

**Embrol'dery** (O.Fr. *embroder*, from *bord*, border), figured work in gold, or silver, or silk thread, wrought by the needle, upon cloths, stuffs, or muslins. In embroidering stuffs a kind of stretching-frame is used, because the more the piece is stretched the easier it is worked. The art was common in the East in very ancient times. The Jews appear to have acquired it from the Egyptians; Homer makes frequent allusion to it; and Phrygia was celebrated for its embroidery, which was in great demand at Rome. The Nineveh mural reliefs in the British Museum show Assyrian robes with floral ornaments, and a relief (now in the Louvre, Paris) from the palace of Darius I shows Persian robes with embroidery. The Anglo-Saxons had a Continental reputation, and from the eleventh to the sixteenth century the art of pictorial needlework was of the highest importance both as a

recreation and as an industry. Embroidery is commonly divided into two classes: white embroidery applied to dress and furniture, in which the French and the Swiss excel; and embroidery in silk, gold, and silver, chiefly in demand for ecclesiastical vestments. The Chinese, Hindus, Persians, and Turks excel in such work.—*Cf.* Christle, *Embroidery and Tapestry Weaving*.

**Embrun** (an-brûn), a picturesque walled town, France, département Hautes-Alpes, on a rocky eminence on the Durance. It was sacked successively by Vandals, Huns, Saxons, and Moors, by the Protestants in 1573, and by the Duke of Savoy in 1692. It has a fine cathedral. Pop. 3550.

**Em'bryo**, an immature organism, especially in the earlier stages of development from the fertilized ovum onwards. The embryo of a mammal (except in the egg-laying duck-bill and spiny ant-eater), which develops internally, is known as a *fetus*. The dormant plantlet in a seed is also known as an embryo.

**Embryol'ogy**, the branch of biology concerned with the fertilization of the ovum and its development into the adult. Aristotle and Galen made some observations on the subject, as regards animals, while Harvey and his successors considerably advanced our knowledge, but as a distinct and important subject embryology only dates from the nineteenth century. In the course of its development an organism repeats the evolution of its group in an abbreviated fashion, thus furnishing a clue to its actual affinities. The subject also throws light on the problems of heredity.

**Embryo-sac**, the name given to the megaspore of seed-plants. In Angiosperms the ripe embryo-sac is typically a large ovoid sac enclosed in a thin membrane and lined by cytoplasm; it contains seven or sometimes eight nuclei with associated masses of cytoplasm, distributed in a characteristic manner. At the apical end, next the micropyle, is the egg-apparatus, comprising the egg-cell or ovum flanked by the two synergids or helping-cells, while the basal or chalazal end is occupied by the three antipodal 'cells'. The cavity of the sac is filled with cell-

sap traversed by stout protoplasmic strands, suspended in which, near the centre, are two polar nuclei, or a single fusion-nucleus formed by the union of these. A characteristic feature of Angiosperms is the process of 'double fertilization'. The pollen-tube contains two male gametes, both functional; one fertilizes the egg-cell, the resulting zygote or oospore giving rise by cell-division and growth to the embryo; the other unites with the fusion-nucleus (or the two polar nuclei), and the product is the origin of the special nutritive tissue or endosperm, which is used up by the embryo, either during ripening of the seed (exalbuminous seeds), or at germination (albuminous seeds). See *Gymnosperms*; *Ovule*.

**Em'den**, a town of Prussia, province of Hanover, near the mouth of the Ems, occupying a low flat intersected by numerous canals. It was raised to the rank of a free Imperial city in 1595, was made a free port in 1751, was incorporated with the kingdom of Hanover in 1815, and in 1866 was united to Prussia. The principal building is the great church, built in 1455. The harbours admit large vessels, and several canals run inland. It exports grain, dairy produce, and gin, and has shipbuilding yards, and manufactures hosiery and leather. Pop. 24,000.

**Em'erald**, a variety of beryl, a well-known gem of pure green colour, somewhat harder than quartz; specific gravity, 2.67 to 2.73. It is a silicate of aluminium and the rare element glucinum or beryllium, which was detected in it by Vauquelin after it had been discovered by the same chemist in the beryl. Its colour is due to the presence of chromium, of which there may be 0.2 to 0.8 per cent present. Its natural form is either rounded or that of a short six-sided prism. It is one of the softest of the precious stones, but is not acted on by acids. Emeralds of large size and at the same time free from flaws are rare and more valuable than diamonds or rubies; the largest on record is said to have been possessed by the inhabitants of the valley of Manta in Peru when the Spaniards first arrived there. It was as big as an ostrich egg, and was worshipped as *the mother of emeralds*. The ancients, who valued them, especially for engraving, are said to have procured them from Ethiopia and Egypt. The finest are now obtained from Colombia. The Oriental emerald is a variety of the ruby, of a green colour, and is an extremely rare gem.

**Emerald Green**, a vivid light-green pigment, an aceto-arsenite of copper, used both in oil and water-colour painting. It is extremely poisonous. Hydrated chromium sesquioxide is another mineral emerald green. There is also an aniline dye of this name.

**Emerald Lore** The emerald as a sacred



Almost Ripe Embryo-sac  
of *Lilium Martagon*

A, Antipodal. P, Polar  
nuclei. E, Egg-cell. S,  
Synergids.

stone was anciently believed to blind a serpent which gazed at it, but to strengthen human eyes, and was, according to Theophrastus, worn as a ring-stone on account of this property. It was confused with 'false emerald', a kind of malachite. This fact explains the reference to ancient kings presenting blocks of emerald 1 or 2 cubits long to temples. The Babylonian name was *barraktu*, the Sanskrit *marakata*, the Hebrew *bareket* or *barkal*, the Greek *maragdos* or *maragdos*.

**Emergences**, in botany. See *Hairs of Plants*.

**Em'erson**, Ralph Waldo, an American poet and prose writer, born at Boston, 25th May, 1803, died 27th April, 1882. He graduated at Harvard in 1821, for five years taught in a school, and in 1829 became minister of a Unitarian Church in Boston, but in 1832 resigned his charge. He spent the greater part of 1833 in Europe, and on his return began his career as a lecturer on various subjects, in which capacity he acted for a long series of years. In 1835 he took up his permanent residence at Concord, Mass., and in 1836 published a small volume called *Nature*. He was one of the original editors of *The Dial*, a transcendental magazine begun in 1840. Two volumes of his essays were published, in 1841 and 1844, and his poems in 1846. His miscellaneous addresses had been published in England in 1844, and on visiting Great Britain in 1847 he was welcomed by a large circle of admirers. In 1850 he published *Representative Men*; in 1856, *English Traits*; in 1860, *The Conduct of Life*; in 1869, *May Day and Other Poems*, and *Society and Solitude*; in 1871, *Parnassus*, a collection of poems; in 1870, *Letters and Social Atoms*. Emerson showed certain similarities with Carlyle, of whom he was a friend and correspondent. Their correspondence appeared in 1883. He was not only one of the most original and influential writers that the United States have produced, but also one of the most helpful and influential ethical teachers of the nineteenth century. His gospel of self-reliance, his insistence on the duty of self-respect, and the obligation to listen to the voice of one's own soul, have exerted a wide influence which has grown steadily. — **BIBLIOGRAPHY**: J. E. Cabot, *Emerson's Complete Works* (11 vols.); G. W. Cooke, *Ralph Waldo Emerson: his Life, Writings and Philosophy*; J. Elliott Cabot, *A Memoir of Ralph Waldo Emerson*; R. Garnett, *Life of Ralph Waldo Emerson*; G. S. Woodberry, *Ralph Waldo Emerson*; J. A. Hill, *Emerson and his Philosophy*.

**Em'ery** (formerly *emeril*, from O.Fr. *emeril*; Gr. *emiris*, emery), an impure variety of corundum, of blackish or bluish-grey colour, chiefly found in shapeless masses and mixed with other minerals. It contains about 82 per cent of

alumina, and a small portion of iron; is very hard; is practically infusible, and is not attacked by acids. The best emery is brought from the Levant, chiefly from the island of Naxos. It is employed in cutting and polishing precious stones; in smoothing the surface of the finer kinds of lenses preparatory to their being polished; in the polishing of marble; by cutlers, locksmiths, glaziers, and other artisans. For all these purposes it is pulverized in large iron mortars or in steel mills, and the powder, which is rough and sharp, is carefully washed and sifted into eight or ten different degrees of fineness. Emery-paper and emery-cloth are made by laying a thin coat of glue upon the fabric, and dusting the emery from a sieve of the required size.

**Emet'ic** is a substance given to produce vomiting, either acting directly on the nerves of the stomach, or indirectly through the bloodstream on the vomiting centre in the brain. In the first group are common salt, mustard, ipecacuanha, and sulphate of zinc; and apomorphine, which is given hypodermically, is an example of the second. Emetics are not now so widely used, as in many cases the stomach can be more effectively emptied and then washed out by the passage of the stomach-tube.

**Em'etine** is an alkaloid present in ipecacuanha. It is a powerful emetic, and whether given by the mouth or hypodermically produces vomiting with nausea and depression. It acts chiefly as a local irritant to the lining of the stomach. In minute doses it stimulates expectoration from the lungs.

**Emeu**, or **Emu**, a large flightless running bird (*Dromæus novaehollandiæ* and *D. irroratus*), for-



Emeu or Emu (*Dromæus novaehollandiæ*)

merly dispersed over the whole Australian continent, but now almost extinct in many districts. It is allied to the cassowary, but is distinguished



by the absence of a 'helmet' on the top of the head. It nearly equals the ostrich in bulk, being thicker in the body, though its legs and neck are shorter. Its feet are three-toed (the ostrich has two toes), and its feathers, which are double, are of a dull sooty-brown colour, those about the neck and head being of a hairy texture. The wings are small and useless for flight, but the bird can run with great speed. The flesh of the young emeu is by some considered a delicacy. The emeu is a bird of the plain, the cassowary of the forest. It is easily tamed, and may be kept out of doors in temperate climates. It feeds on vegetable matter, fruits, and roots.

Emeu Wren (*Stipitarius malachurus*), a small Australian bird allied to the warblers, somewhat similar to a wren, but having the tail-feathers long, soft, and thinly barbed, similar to emeu feathers.

Emigration, the movement of individuals or groups from one state or country to a colony or another country, to be distinguished from *migration*, which describes the movement of peoples or races from one geographical area to another, and from *colonization*, which implies the foundation of a new state or extension of the sway of the colonists' state of origin. Thus the term does not strictly apply to the migrations of prehistoric times; nor to the movements of the Indo-European races (to which reference occurs in the Old Testament) which took place before the state as a territorial conception had developed; nor does it describe the great barbarian invasions of the early Christian era. There was comparatively little emigration among the Greeks and Romans, movement among the former being usually for the foundation of colonies or new states, and among the latter as a means of consolidating conquests. In Europe up to the seventeenth century, emigration was sporadic, notable instances being the movement from Flanders to England in the fourteenth century, and of Protestants from France to England in the sixteenth and seventeenth centuries. In the seventeenth century, with the growth of European colonies in America and the East, there was much emigration to those places, notably from Spain, Portugal, and Great Britain to America, and from the Netherlands to the East. In the eighteenth century the movement slackened, but in the nineteenth century, largely as the result of the industrial revolution and the decay of agriculture, the great era of emigration began, especially from the United Kingdom. During the nineteenth century the main stream has flowed westward into America from Europe. Particularly important have been the emigration of Irish to the United States, and of Germans to South America. There has also been considerable movement from Russia

into the United Kingdom, in many cases as a half-way house to the United States. In the East, emigration from China and Japan to the United States and Australia, and from India to British tropical colonies, has been important. It is noticeable that the Latin and Yellow races as a rule emigrate with the idea of returning ultimately to their native country; with the Anglo-Saxon, Teutonic, and Slav races the aim of a permanent domicile is predominant.

The most important causes of emigration are love of adventure, political or religious difficulties, and economic pressure. Forced emigration, in the shape of transportation, was formerly of some importance, especially in the case of America and Australia, but is now negligible; and before the European War, emigration from Russia was chiefly for political or religious reasons. To-day economic forces are the most powerful. The direction of the flow of emigration is partly determined by its causes. When these are political or religious, emigrants go where they expect to find freedom, as with the Huguenots in the seventeenth century. When economic forces are at work, emigration takes place towards newer and less developed countries, where pressure on the means of subsistence is less marked than elsewhere. Assistance given to emigrants, such as grants of land, loans of capital, and passages at reduced rates also has an influence, likewise the regulations of the countries concerned regarding emigration and immigration. In Australia and the United States, regulations forbidding the entrance of Yellow races have checked the movement of Chinese and Japanese to those countries; and the Government of India discourages emigration save under adequate safeguard for proper pay and treatment.

The results of emigration vary with the economic and other circumstances of the countries concerned. The country from which the movement takes place loses intellectual and physical labour power which the other country gains; but may benefit by relief given to a congested labour market. This was the case with the Netherlands in the seventeenth century, and the United Kingdom in the early nineteenth century. The general tendency is for emigration to benefit the world as a whole by enabling labour to go where it can be most productively employed. This increases world production, opens up new markets, and so indirectly benefits the older countries. Sometimes, however, emigration may cause an industry merely to be transferred from one country to another, as in the case of the fourteenth-century Flemish emigration to England. The importance of these results of emigration in any particular case depends on the class of people who emigrate,

and on the volume of emigration. Deportation of criminals obviously benefited only the deporting country. Emigration on political or religious grounds has frequently deprived one country of, and given to another, a vigorous and industrious stock, as in the case of the French Huguenots driven from France to England in the late seventeenth century by the revocation of the Edict of Nantes. Economic pressure tends to send abroad agricultural and other unskilled labour. The majority of emigrants from Great Britain in the nineteenth century belonged to this class. Youth and adaptability, however, are more important qualities for an emigrant than a high level of skill in any trade; and it is probable, therefore, that on the whole emigration has relieved Europe of labour whose supply was in excess of the demand for it, and has never given newer countries the material they require. The political consequences of emigration may also be important. Some writers claim that it has assisted the spread of democracy. Whether this is an advantage is a matter for individual judgment. But emigration may certainly have much influence in creating and maintaining friendly relations between States; or, as shown by Irish influence in the United States, it may embitter the feeling between them.—BIBLIOGRAPHY: Mayo-Smith, *Emigration and Immigration*; S. C. Johnson, *History of Emigration from the United Kingdom to North America, 1763-1912*.

Émigrés (ā-mi-grās), a name given more particularly to those persons who left France during the Revolution of 1789. At the head of these emigrants stood the royal princes of Condé, Provence, and Artois, the first of whom collected a part of the fugitives to co-operate with the allied armies in Germany for the restoration of the monarchy. At Coblenz a particular court of justice was established to settle causes relating to the French émigrés. The corps of Condé was finally taken into the Russian service, and was disbanded in the Russian-Austrian campaign of 1799. When Napoleon became emperor he granted permission to all but a few of the emigrants to return to their country; but many declined to return until after his downfall. By the Charter of 1814 they were shut out from the recovery of their estates and privileges; and though, by a law of 27th April, 1825, some compensation was decreed to them, the grant was withdrawn again after the July revolution.

Emilian Provinces, a term applied to certain Italian provinces annexed to the kingdom of Sardinia in 1860. They comprised the northern part of the States of the Church (Romagna) and the Duchies of Modena and Parma.

Em'puence, an honorary title formerly applied to the Emperor and higher officials of the Empire,

but restricted in 1630 by Pope Urban VIII to cardinals. Up to that time they had been called *illustrissimi* and *reverendissimi*.

Emîr (em'ër), the title given by Mohammedans to independent chiefs or princes, *Amîr* or *Ameer* being the same word (the *Amir* of Afghanistan). When associated with other words it may designate various dignitaries. Thus the caliphs styled themselves *Emîr-al-Mumînîn*, Prince of the Faithful; *Emîr-al-Omrah*, Prince of Princes, was the title of governors of certain provinces. The title is also given in Turkey to all the real or supposed descendants of Mohammed, through his daughter Fatimah.

Emmerich (em'e-rih), a town, Rhenish Prussia, on the right bank of the Rhine, 5 miles N.E. of Cleves. It joined the Hanseatic League in 1407. It carries on an active trade chiefly with Holland. Pop. 18,418.

Em'met, Robert, an Irish rebel, born at Cork in 1778. He was expelled from Trinity College, Dublin, in 1798, on the ground of exciting disaffection and rebellion, and having become an object of suspicion to the Government, quitted Ireland. He returned there on the repeal of the suspension of the Habeas Corpus Act, and became a member of the Society of United Irishmen for the establishment of the independence of Ireland. In July, 1803, he was the ringleader in the foolish rebellion in which Lord Kilwarden and others perished. He was arrested a few days afterwards, tried, and executed. His fate excited special interest from his attachment to Sarah Curran, daughter of the celebrated barrister. Their sad fates were commemorated by his college friend, Moore, in *Oh, Breathe Not his Name, and She is Far from the Land where her Young Hero Sleeps*.

Emotion, a term variously used by psychologists; sometimes as one of the divisions of feeling, the other being sensation; sometimes as opposed to feeling when the latter is identified with sensation, and sometimes as distinct from both sensation and feeling, when the last term is rigidly confined to the sense of pleasure or pain. In any of these uses, however, emotions are distinguished from sensations in that sensations are primary forms of consciousness arising by external excitation, are comparatively simple and immediately presentative phenomena, and are definite in character and capable of localization; while emotions are secondary or derived forms of consciousness, are complex and representative, and are vague and diffused. Sensations are said to be 'peripherally initiated', while emotions are centrally initiated. When, in addition to its being distinguished from sensation, it is also distinguished from feeling, emotion is applied to the whole physical condition accompanying the sense of pleasure or pain (feeling). The muscles of the body and

the organic functions of the system are often considerably influenced by emotion, which naturally seeks an outward expression unless held in check by what Darwin has called serviceable associated habits. — BIBLIOGRAPHY: A. Bain, *The Emotions and the Will*; J. M'Cosh, *The Emotions*.

**Empedocles** (-klēz), a Greek philosopher of Agrigentum, in Sicily, born about 480 B.C. He is said to have introduced the democratic form of government into his native city, and the Agrigentines regarded him with the highest veneration as public benefactor, poet, orator, physician, prophet, and magician. Aristotle states that he died in obscurity, at the age of sixty years, in the Peloponnese; but he is also said to have thrown himself into the crater of Mount Etna, in order to make it be believed, by his sudden disappearance, that he was of divine origin, and had been translated to heaven alive (cf. Matthew Arnold's *Empedocles on Etna*). According to Lucian, however, his sandals were thrown out from the volcano, and the manner of his death revealed. Empedocles held earth, water, fire, air, as the four fundamental and indestructible elements from whose union and separation everything that exists is formed. To these material elements are added the two moving or operative principles of love and hatred, or attraction and repulsion. He wrote his philosophy in verse; of his chief work, *On Nature*, about 400 lines out of the original 5000 are preserved.

**Em'peror** (from the Lat. *imperator*; in Ger. *Kaiser*, from *Cæsar*), the title of the highest rank of sovereigns. The word *imperator*, from *imperare*, to command, in its most general sense signified the commander of an army. After the overthrow of the Roman republic *imperator* became the title of the rulers or emperors, and indicated their supreme power. Victorious generals were still, however, sometimes saluted with the title *imperator*, in its original sense. With the fall of Rome the title was lost in the West, but was kept up in the Eastern or Byzantine Empire for nearly ten centuries. In 800 it was renewed in the West when Charlemagne was crowned, by Leo III, as 'Carolus Augustus, the God-sent, pious, and great emperor of Rome'. It was, however, for many centuries considered necessary to be crowned at Rome, in order to be formally invested with the title of *emperor*. The imperial dignity became extinct in the East after the conquest of Constantinople in 1453, but the title was adopted by Peter I of Russia in 1721. Napoleon I adopted the old idea of an empire as a general union of states under the protection, or at least political preponderance, of one powerful state; and he was followed in this by his nephew, Napoleon III. In 1806 the first German Empire, 1000 years old, became

extinct, and the German Emperor, Francis II, adopted the title of Francis I, Emperor of Austria. In Dec., 1870, the second German Empire was formed, King William of Prussia having accepted the imperial office and title offered him at Versailles. This empire came to an end in Nov. 1918. Britain is considered as an empire, the crown as imperial, and the Parliament is styled the *Imperial Parliament of Great Britain and Ireland*. Queen Victoria assumed the title of *Empress of India* in 1876, but the British sovereign has not the imperial title in reference to the home dominions. The sovereigns of Japan and Morocco are often, though with little propriety, called *emperors*. — Cf. Articles *Imperator* and *Princeps* in *Smith's Dictionary of Greek and Roman Antiquities*.

**Emperor Moth** (*Saturnia pavonia*) a British moth belonging to a family Saturniide, of which some Indian species produce tussore silk. The colour is greyish-brown, with a faint purple tinge. The wings are about 3 inches in expanse, and in the centre of each is a large eye-like spot. The larva is of a bright-green colour, and studded with large rose-coloured or yellow tubercles.

**Empetracææ**, a small nat. ord. of henth-like Dicotyledons, of which the type is the crowberry.

**Em'phasis**, in rhetoric, a special stress or force given to some syllable, word, or words in speaking, in order to impress the hearers in some desired manner, thus differing from *accent*, the position of which is fixed.

**Emphyse'ma** is a distention of the tissues with air or other gases. Several forms are recognized: *pulmonary emphysema*, due to dilatation of the minute air-passages with loss of elasticity of the lung tissues; *surgical emphysema*, due to distention of the subcutaneous tissues by air, seen in certain wounds and injuries; *atrophic emphysema*, due to a senile condition of the lung tissues.

**Empire Day**, a British imperial celebration which is held annually on the 24th of May, the birthday of Queen Victoria. The celebration was officially held for the first time in 1904, and has since gained wide recognition, mainly owing to the unremitting efforts of the twelfth Earl of Meath.

**Empir'ic** (Gr. *empeiria*, experience) was used in medical history to denote one of a sect of physicians who held that observation and experience were the basis of medicine. The modern use of the term, medically, is restricted to one who practises medicine without any professional education or training.

**Empiricism** (Gr. *empeiria*, experience), the philosophical theory according to which sense-experience is the source of all knowledge, i.e. that we can investigate the world only through

the experience of our senses. It denies the existence of any *a priori* possibility of knowledge, and maintains that the mind is at first a *tabula rasa*, a clean slate, upon which all the characters are inscribed by experience. The term empiricism is, however, now applied to any philosophical system which finds all its material in experience. The philosophy of empiricism has been particularly developed by English writers of the seventeenth, eighteenth, and nineteenth centuries, such as Locke, Hume, and J. S. Mill. John Locke was the first to express the view in a systematic form. Among more modern empiricists are William James and John Dewey.—**BIBLIOGRAPHY:** Green, *Prolegomena to Ethics*; James, *Essays in Radical Empiricism*.

**Employers' Liability Act**, a British Act of Parliament passed in 1880, by which, within certain limits, an injured workman or, in event of his death, his relatives or representatives may claim from the employer compensation for injuries received in his service. The law on this subject was improved by the Workmen's Compensation Act (1897) and its amending Act (1900). These applied to those employed on, in, or about railways, factories, mines, quarries, engineering works, buildings, and to agricultural labourers. An Act of 1906 added other classes of workers, including domestic servants. The maximum compensation on death is three years' earnings or £150, whichever is larger, but not more than £300. Contracting-out is carefully safeguarded. The maximum weekly benefit was raised from £1 to £1, 5s. in 1917, and £1, 15s. in 1920, in cases of total incapacity. Recommendations by the Board of Trade Departmental Committee were made public in July, 1920. These suggest greater powers of Government control, compulsory insurance, and greatly increased compensation in cases of death and total incapacity.

**Employment Bureaus** were first established on a considerable scale in the United Kingdom by the Labour Exchanges Act 1909. They were to some extent based upon the German public labour exchanges, which came into being after 1898 in most large towns, and were either municipal or maintained by voluntary associations and supported by the municipality. Their chief object was to put employers and work-people into touch with a view to employment. Before 1909 a few public employment bureaus had been established in Great Britain. An Act of 1905 established distress committees in boroughs and urban districts, which were given power to establish labour exchanges. These powers were in some cases exercised, either by taking over existing bureaus or establishing new ones. Only in London was the system of importance. The 1909 Act gave the Board of Trade power to

establish labour exchanges; and, by regulations under the Act, the United Kingdom has been divided into divisions in each of which are a number of exchanges of different grades. The system is industrial and not eleemosynary, aiming solely at providing a recognized market-place for labour. No fees are charged, and use of the exchanges is voluntary. Work-people may register at an exchange between certain hours, and, when a suitable vacancy occurs, the applicant is sent to the employer. Applications for work-people are generally received by telephone, and are recorded if no suitable applicant is available. An important part of the work of the labour exchange is in connection with Unemployed Insurance, under Part II, National Insurance Act, 1911. This provided for payment of unemployed benefit in a limited number of occupations. Subsequent Acts (notably that of 1920) have extended the system to cover the majority of occupations. The scheme is contributory, but the State shares the cost with employers and work-people.—**BIBLIOGRAPHY:** W. H. Beveridge, *Unemployment*; F. A. Kellor, *Out of Work: a study of unemployment*.

**Em'poll**, a town in North Italy, on the left bank of the Arno, 16 miles w.s.w. of Florence; it has an old collegiate church with good paintings, and manufactures of straw-bonnets. Pop. 21,500.

**Empo'ria**, a town of the United States, in Kansas, on the Neosho River, with a normal school, and a good trade in grain and cattle. Pop. 9050.

**Empyreu'ma**, the smell arising from organic matter when subjected to the action of fire, but not enough to carbonize it entirely. The products of imperfect combustion, as from wood heated in heaps or distilled in close vessels, are frequently distinguished as empyreumatic.

**Ems**, or **Bad Ems**, a beautiful watering-place in the Prussian province of Hesse-Nassau, on the River Lahn, not far from its confluence with the Rhine. Its mineral waters are warm—from 70° to 118° F.—contain large quantities of carbonic acid gas, and are used in chronic catarrhs, pulmonary complaints, diseases of the stomach, gout, and some diseases of the urinary vessels. There are about 8000 visitors each season. Pop. 6850.

**Ems**, a river of North-West Germany, which flows north-west through Rhenish Prussia and Hannover, and falls into the Dollart Estuary near Emden; length 230 miles.

**Emu**. See *Kineu*.

**Emul'sine**, or **Synaptase**, originally the name given to the mixture of enzymes in bitter and sweet almonds. Emulsine has the property of being able to hydrolyse the glucoside amygdalin to glucose, benzaldehyde, and hydrocyanic acid.

*E'mys*, a genus of water-tortoises native to Europe and North America, and belonging to the family Testudinidae, which includes most reptiles of the tortoise kind.

*Enallosaurians* ('seu-lizards'), a group of gigantic Mesozoic reptiles of which the ichthyosaurus and plesiosaurus were the chief.

*Enamel*, a vitreous glaze coloured with metallic oxides, and, when first introduced, made to adhere by fusion on metals, &c. The ancient Babylonians enamelled bricks. No finer enamelling on bronze was done than that done in early Britain. The ancient Britons achieved great skill in decorating bronze shields, armlets, chariot pieces, helmets, &c., with red, blue, and white enamel during the Late Celtic (Early Iron Age) period and later. Indeed it is believed that the *champlevé* process of excavating hollows for enamel on metal in various flowing and artistic designs of symbolic character was developed in pre-Roman Britain. Philostratus, a third-century classical writer, referring to the enamelled trappings of horses, remarks that "the barbarians who reside in Ocean pour these colours on heated bronze, so that they adhere and become hard as stone". Beautiful specimens of enamelled bronze found in England, Scotland, and Ireland, preserved in the British Museum, include the Battersea and Witham shields, bridle-bits from Dumfries, and Rise, near Hull, and an enamelled 'terret' from the Fayum, Egypt, whither, archaeologists believed, it was taken by some Roman soldier. Enamelling on bronze and iron was practised in Central Europe and at Koban in the Caucasus at an earlier date than in Italy and Egypt. Byzantine enamels on gold date from the tenth century. M. Salomon Reinach was the first to point out that red enamels were used as substitutes for coral, which, by the way, had a religious value as a 'life giver' and 'protector'. The later blue enamel may have been a substitute for lapis-lazuli, and other enamels, white, violet, green, and yellow, for other sacred stones. The ancient enamels are more or less opaque. Transparent enamels were favoured in the thirteenth century by Italian goldsmiths. A favourite method of applying



Alfred's Jewel

A jewel of blue enamel enclosed in a setting of gold, with the words wrought in it: "Ælfred had me wrought", found at Athelney, Somersetshire, in the seventeenth century.

enamel is known as *cloisonné*, which means inlaid between partitions. The design is outlined in bent-wire fillets, which are fastened to the plate by means of silver solder or the enamel itself. In *champlevé* work the plate itself is scooped out into channels for the enamel. The distinction between *cloisonné* and *champlevé* work, therefore, is something like the distinction between a breastwork and a trench. Enamelled glass is really deeply coloured glass. Bicycle enamel is made of asphalt or resin dissolved in oil, each coat being hardened by heat. Enamel paint is made by mixing copal varnish, &c., with metallic oxides. A special preparation is applied to leather which is afterwards heated—this is 'patent leather'. Enamel painting dates back to the sixteenth century and is used nowadays chiefly for street signs and advertisements. The term 'enamel' is applied to the hard protective coating of teeth.—BIBLIOGRAPHY: E. Molinier, *Dictionnaire des émailleurs*; H. Cunyngame, *Art of Enamelling*; A. Fisher, *The Art of Enamelling upon Metal*; H. M. Chapin, *How to Enamel*.

*Enare'a*, a lake in the north of Finland, about 50 miles long by 30 miles broad. It is studded by innumerable islets, receives several streams, and is connected by the Patajoki with the Arctic Ocean. At its south-west extremity is a small fishing-town of the same name, with an annual fair.

*Enare'a*, a region belonging to the country of the Gallas, south of Abyssinia. Sakha is the principal town. Coffee and ivory are the chief exports. The inhabitants are the most civilized of the Gallas.

*Encar'pus*, in architecture, a sculptured ornament in imitation of a garland of fruits, leaves, or flowers, suspended between two points. The garland is widest in the middle, and diminishes gradually to the points of suspension, from which the ends generally hang down. The encarpus is sometimes composed of an imitation of drapery similarly disposed, and sometimes of an assemblage of musical instruments, implements of war or of the chase.

*Encaustic Painting*, a kind of painting practised by the ancients, for the perfecting of which heating or burning-in was required. Pliny distinguishes three species, in all of which wax was used with colours, and applied either with bronze instruments (cauteria), a sharp-pointed tool (cestrum), or brushes. The art has been revived in modern times, but has not been greatly employed. As the chief aim in encaustic painting was the securing of permanence and durability by the application of heat, the word *encaustic* has been applied to other and widely different processes. Thus it has been used for painting on earthen vessels, for painting on porcelain and work in enamel; and in the same way it

was given to the painting on glass of the Middle Ages.—Cf. A. P. Laurie, *Greek and Roman Methods of Painting*.

**Encaustic Tiles**, ornamental paving-tiles of baked pottery, much used during the Middle Ages in the pavements of churches and other ecclesiastical buildings. The encaustic tile, strictly so-called, was decorated with patterns formed by different coloured clays inlaid in the tile and fired with it. The art appears to have originated in the latter part of the twelfth century, to have attained its highest perfection during the thirteenth, and to have sunk into disuse in the fifteenth. During the whole of this period it was principally carried on in England and Normandy. After a long lapse the art was revived in England in 1830 by Wright, a Shelton potter. In modern manufacture two methods are employed, the 'plastic' and the 'semi-dry' or

and hieratic (used by the priests). It is also called *Demotic*.

**Encke** (en'ke), Johann Franz, German astronomer, born at Hamburg in 1791, died in 1865. He studied under the astronomer Gauss at Göttingen. During the War of Liberation (1813-5) he served as artilleryman in the German army, and after the peace became assistant in the observatory of Serberg, near Gotha. Here he calculated the orbit of the comet observed by Mechain, Miss Herschel, and Pons, predicted its return, and detected a gradual acceleration of movement, ascribed by him to the presence of a resisting medium. The comet is now known as Encke's comet. The fame of his works *Die Entfernung der Sonne* (The Distance of the Sun) and *Der Venusdurchgang von 1769* (Transit of Venus of 1769) led to his appointment as director of the Berlin Observatory (1825), a position which he held till his death. From 1830 he edited the *Berliner Astronomisches Jahrbuch*.

**Encke's Comet**. This object was seen in 1786, and at some subsequent returns, before it was discovered by Encke in 1810 to be a periodic comet. It has since been observed at numerous returns. It revolves round the sun in about three and one-third years, having the shortest period of any comet known. It has exhibited very prominently the feature, shown by many comets, of a contraction of the head or coma on approaching the sun. Encke's comet long manifested the most remarkable feature of a shortening of its period by about two and a half hours in each revolution. The suggestion was made that this was due to resistance by a rare medium generally diffused in the solar system, which had the effect of reducing its aphelion distance and diminishing its orbit. This, however, is improbable, as other comets show no similar effect. The cause remains undiscovered, and a further extraordinary fact is that the shortening of period is found since 1868 to have been only half of its previous amount.

**Enclave** (an-klav), a term used in German and French to denote a place or country which is entirely surrounded by the territories of another power.

**En'crinite**, or **Crinoides** (Gr. *krinon*, lily, and *eidos*, form), a name often applied to all the marine animals of the class Crinoidea or stolidites, phylum Echinodermata, except feather-stars; but more specifically restricted to the genera having rounded, smooth stems attached to the bottom, and supporting the body of the animal, which has numerous jointed arms radiating from a central disc, in which the mouth is situated. Encrinites were exceedingly numerous in past ages of the world's history; of those still existing our knowledge has been greatly increased of recent years through deep-sea dredging. Some



Encarpus, from Palazzo Niccolini, Rome

'dust' method. The first is, in all essentials, that used in the Middle Ages, except, perhaps, in the perfection of modern moulding appliances; the second consists in ramming pulverized clay with a minimum of moisture into metal dies, the subsequent firing of tiles thus consolidated being attended with less risk from shrinkage.

**Ence'nia**, festivals anciently commemorative of the founding of a city or the dedication of a church; and in later times periodical ceremonies, as at Oxford, in commemoration of founders and benefactors.

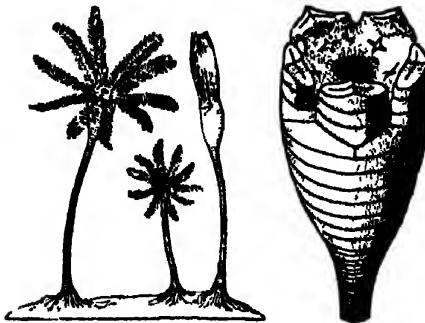
**Encephalartos**, a genus of Cycads, natives of Africa. Meal (Kaffir-bread) is made from the pith by the natives.

**Enchanter's Nightshade**, a name common to plants of the genus *Cleron*, nat. ord. Onagraceae, of which there are two British species, *C. luteiflora* and *C. alpina*. The former is about a foot and a half high, and has delicate ovate leaves, small white flowers tinged with pink, and small roundish fruits covered with hooked bristles. It abounds in shady woods. *C. alpina*, which is similar, but smaller and more delicate, is found in Scotland and north of England. They have no affinity with the nightshades.

**Enchorial** (en-kō'ri-al) Writing, the form of writing used by the old Egyptians for the common purposes of life, as distinct from the hieroglyphic

of these forms are very graceful and interesting. See *Crinoidea*; *Echinodermata*.

**Encyclical**, a sort of circular letter or manifesto issued by a pope, and directed to the Roman Catholic clergy generally or to those of a certain country or area, giving instructions as to conduct to be observed at certain conjunctures, condemning erroneous doctrines, &c. The encyclical, which is a somewhat less formal document than a bull, was especially favoured by Pope Pius IX and Leo XIII. Pope Pius IX issued one in 1864, wherein he condemned eighty alleged errors in modern ideas of religion and civilization, and Pius X issued another in 1907, wherein he condemned modernism. A number



Fossil Encrinurids

Group of Pear-encrinurids, much reduced, on left, and part of a Pear-encrinurite, reduced, on right.

of encyclicals was issued by Pope Leo XIII on Bible Study, Socialism, Capital and Labour.

**Encyclopedia** (Gr. *en*, in, *kyklos*, a circle, and *paideia*, instruction), a systematic view of the whole extent of human knowledge or of particular departments of it, with the subjects arranged generally in alphabetic order. Varro and Pliny the elder, among the Romans, attempted works of an encyclopedic nature, the latter in his well-known *Historia Naturalis*, or *Natural History*. Other ancient encyclopedic works were those of Stobæus and Suidas, and especially of Marcellinus Capella. In the thirteenth century a work on a regular plan was compiled by the Dominican Vincent of Beauvais (died 1264), in which was exhibited the whole sum of the knowledge of the Middle Ages. His work was entitled *Speculum Historiale, Naturale, Doctrinale*, to which an anonymous author added, some years later, a *Speculum Morale*. Roger Bacon's *Opus Majus* also belonged to the encyclopedic class. An exceedingly popular work was the *De Proprietatibus Rerum* of Bartholomæus de Glanvilla, an English Franciscan friar, which maintained its reputation from 1800 to

the middle of the sixteenth century. In the seventeenth century various encyclopedic works were compiled, such as the Latin one of Johann Heinrich Alsted (in 7 vols., Herborn, 1620). In 1674 appeared the first edition of Moreri's *Le Grand Dictionnaire Historique*; in 1677 Johann Jacob Hoffmann published at Basel his *Lexicon Universale*; and in 1697 appeared Bayle's famous *Dictionnaire Historique et Critique*, which is still of great value. The first English alphabetical encyclopædia was the *Lexicon Technicum*, published in 1704. Among the chief English works of this kind are: 1. Ephraim Chambers's *Cyclopædia, or A Universal Dictionary of Arts and Sciences*, published in 1728 in 2 vols. folio. 2. *The Encyclopædia Britannica*, published in Edinburgh, in nine editions—the first in 1788, the ninth in 1875–88 (24 vols. 4to, with supplement, 11 vols., 1902–3). The tenth edition was published in 1902, and the eleventh issued in 1910–11 by the University Press, Cambridge. 3. Rees' *Cyclopædia*, 39 vols. 4to, illustrated, 1802–20. 4. *Edinburgh Encyclopædia*, 1810–30, 18 vols. 4to, conducted by Sir David (then Dr.) Brewster. 5. *Encyclopædia Metropolitana*, London, 20 vols. 4to, and containing some valuable complete treatises. 6. *The London Encyclopædia*, by Thomas Curtis, 22 vols. 4to; London, 1829. 7. *The Penny Cyclopædia*, in 28 vols. small folio, 1833–43; since recast under the name of the *English Cyclopædia*. 8. Chambers's *Encyclopædia*, in 10 vols. 9. *The Popular Encyclopædia*, issued in 14 vols. 10. Harnsworth's *Universal Encyclopædia*. 11. Nelson's *The New Age Encyclopædia*. 12. *The New Gresham Encyclopædia*, 12 vols. (one being index). The chief American encyclopædias are the *Encyclopædia Americana*, in 18 vols.; the *New American Cyclopædia*, in 16 vols.; Johnson's *Universal Cyclopædia*, 8 vols.; *The New International Encyclopædia*, 25 vols. Of the French cyclopædias the most famous is the great *Dictionnaire Encyclopédique*, by Diderot and D'Alembert (see next article); the *Encyclopédie Méthodique, ou par Ordre des Matières*, Paris, 1781–1832, in 201 vols. 4to, of which 47 are plates; the *Encyclopédie Moderne*, 1824–32, 28 vols.; the *Encyclopédie des Gens du Monde*, 1835–44, 22 vols.; the *Dictionnaire de la Conversation et de la Lecture*, 1851–58; the excellent *Grande Encyclopédie*, 81 vols.; and the large and valuable *Grand Dictionnaire Universel du XIX<sup>e</sup> Siècle*, published by Larousse, 16 vols. folio (with supplementary vols.); *The Nouveau Larousse Illustré*, 7 vols. Numerous works of this kind have been published in Germany, the most popular being the *Konversations-Lexikon* of Brockhaus; Meyer's *Konversations-Lexikon*; Pierer's *Konversations-Lexikon*; and that issued by Spamer. The most comprehensive is the *Allgemeine Encyclopædie*, originally edited by Pro-



fessors Ersch and Gruber, begun in 1818, and not yet completed. *The Rousskiy Entsiklopedicheskiy Slovar*, the best Russian encyclopedia, in 43 vols, was published between 1905 and 1908.

**Encyclopédie** (an-sik-lo-pá-dè), The French, one of the most important literary enterprises of the eighteenth century, originated in a French translation of Ephraim Chambers's *Cyclopædia*. Diderot was appointed to edit it, and enlisted the ablest men of the time as contributors. D'Alembert (who wrote the famous *Discours préliminaire*) edited the mathematics; Rousseau wrote the musical articles; Daubenton, those connected with natural history; the Abbé Yvon, those on logic, metaphysics, and ethics; Tousseint, those on jurisprudence; Buffon contributed the article *Nature*; and Montesquieu, Voltaire, Euler, Marmontel, D'Holbach, Turgot, Grimm, and Condorcet took some share in the great work. Diderot himself was a prolific contributor on a wide variety of topics. The prospectus appeared in Nov., 1750, and the first volume in 1751, the whole being completed, despite fierce opposition, in 1765. The contributors to the *Encyclopédie*, the majority of whom held unorthodox views on religious, political, and social subjects, are known as the *Encyclopédistes*.

**Endemic** (Gr. *en* and *demos*, people) is a term applied to diseases peculiar to people of a particular district or of a nation or country. The cause of this may be due to the physical characters of the place, or to the mode of living, habits, &c., of the people. Diseases endemic in one region may appear elsewhere when similar influences arise.

**End'erb' Land**, an island in the Antarctic Ocean, long. 50° E, crossed by the Antarctic Circle. It was discovered by John Bischoff in 1881.

**End'ive**. See *Chicory*.

**Endless Screw**, a mechanical contrivance, consisting of a screw the thread of which gears into a wheel with skew teeth, the obliquity corresponding to the angle of pitch of the screw. It is generally employed as a means of producing slow motion in the adjustments of machines, rather than as transmitter of any great amount of power.

**Endlicher** (end'li-her), Stephen Ladislaus, Hungarian botanist, born at Presburg in 1804. He was successively court-librarian at Vienna, and keeper of the natural history museum; and in 1840 was appointed professor of botany in the University of Vienna, and director of the botanic garden, which he immediately began to reorganize. He took part on the popular side in the German revolution of 1848, and died by his own hand in 1849. Among his chief botanical works are his *Genera Plantarum*, a

systematic treatise on botany; and his *Enchiridion Botanicum*, or *Manual of Botany*.

**Endocarditis**, is inflammation of the endocardium, which is the lining membrane of the internal surface of the heart.

**Endodermis**, the innermost layer of the cortex. It acts as a 'physiological barrier' between the vascular tissues and the cortex, its structure being such as to compel all interchange of water and other materials between the two to pass through the living protoplasm of the endodermal cells. See *Tissues of Plants*.

**Endog'amy** (Gr. *endon*, within, *gamos*, marriage), a custom among some savage peoples of marrying only within their own tribe; opposite to *exogamy*.

**Endogenous Plants**, old name for monocotyledons. See *Monocotyledonous Plants*.

**Endogenous Structures**, in botany, are those which arise in the interior of the parent organ. Lateral roots furnish the best example. Opposed to exogenous structures (see also *Branching and Root*).

**Endomorph**, a term applied to crystals of minerals enclosed in those of other minerals.

**En'doparasite** (Gr. *endon*, within), a parasite living within, and at the expense of, another organism, as opposed to an *ectoparasite*, which attacks its host from the exterior.

**En'doskeleton**, in anatomy, a term applied to the internal bony structure of man and other animals (Gr. *endon*, within), in contradistinction to *exoskeleton*, which is the outer and hardened covering of such animals as the crab and lobster.

**En'dosmose**, or *Endosmosis*, the transmission of liquids or gases through porous septa or partitions from the exterior to the interior of a vessel. When two different liquids or gases are separated by a porous vessel, the two fluids pass through the walls of the vessel at different rates, causing a change of volume and of pressure inside and outside the vessel. Endosmose is the name applied to the flow towards the fluid which is increasing in volume. When the transfer of liquid across the porous partition takes place in a cell through which an electric current is flowing the effect is called electrical endosmose.

**En'dosperm**, the tissue surrounding the embryo in many seeds and contained with it within the testa. It forms a supply of food for the germinating embryo, and is also called albumen.

**Endym'ion**, in Greek mythology, a huntsman, a shepherd, or a king of Elis, who is said to have asked of Zeus, or to have received as a punishment, eternal sleep. Others relate that Seléné or Diana (the moon) conveyed him to Mount Latmos in Caria, and threw him into a perpetual sleep in order that she might enjoy his society whenever she pleased. Endymion is also supposed to be a personification of the sun, or of

the plunge of the setting sun into the sea.—Cf. Keats, *Endymion*.

**Energy, Physical,** is the capacity which a body or system of bodies has for doing work. Work is done when a force is overcome, and it is measured by the product of the force and the distance through which it is overcome. A quantity of energy is therefore expressed in terms of the same units as work, e.g. the foot-pound and the erg. Energy exists in two forms. Potential energy is that which a body possesses in virtue of its position. For instance, by winding up a clock weight it is given a certain amount of potential energy, which it slowly expends in driving the clock; a bent spring and a mass of compressed air also possess energy in the potential form. This kind may also be noted in the voltaic cell and the charged condenser, and in a chemical form in coal and gunpowder. Kinetic energy is possessed by bodies in virtue of their motion. Thus a moving bullet and a falling hammer contain kinetic energy; bodies which are in a state of vibration are also sources of this form of energy, which is diffused from the body through the surrounding medium in the form of waves, whether of sound, heat, light, or the ether waves of radio-telegraphy. Energy may thus exist in any of the following forms: mechanical (potential, kinetic), sound, heat, light, magnetic, electrostatic, electromagnetic, chemical.

Energy may be transformed from one kind into another. When a pendulum is vibrating, there is a continual transformation of potential into kinetic energy, and vice versa. By rubbing the hands together we convert mechanical energy into heat. In an electric tramway system we may note a whole series of transformations. The chemical energy of the fuel is turned into heat in the furnace and boiler; this, again, into kinetic energy of the turbine and dynamo; the latter gives out electric current, the energy of which, after suffering slight losses as heat in the overhead wire, and as light and sound in the spark at the trolley, passes into the motor, to reappear as kinetic energy of the car.

The transformation of energy takes place according to a definite law. The principle of the conservation of energy states that the total amount of energy in a self-contained finite system is constant. This implies that energy cannot be destroyed, and that when a certain amount of energy disappears, an equal amount appears in another form. This principle is apparently contradicted in many cases of transformation, since it is impossible to transform energy by natural process, or by the use of mechanism, without doing work in overcoming frictional or resisting forces. In all such cases the energy spent is converted into heat, which is

less available as useful energy. The experiments of Rumford, Davy, and Joule were instrumental in establishing the equivalence of mechanical energy and heat. Rumford showed that water could be boiled by means of the heat produced by rotating a blunt boring-tool within a cannon, and pointed out that the heat liberated was, in another form, the energy spent in driving the blunt drill. Davy caused two pieces of ice to be rubbed together within a vacuum at a temperature below zero, and melted the ice, thus showing that, since ice has to absorb heat in order to melt, the supply of heat could not have come from the ice itself, but must have resulted from the work done in rubbing. It has to be remembered that, in the time of Rumford and Davy, the belief was prevalent that heat or caloric was a material substance, and not a form of motion.

A further and most important step was made by Dr. J. P. Joule, of Manchester, who measured the amount of mechanical work which is spent in producing one unit of heat. This is known as the mechanical equivalent of heat, or Joule's equivalent. Two hanging weights were geared to a set of paddles which could rotate within a cylindrical copper vessel filled with water, and supplied with fixed vanes. The weights were released, and in descending a measured distance caused the paddles to churn the water in the vessel, and thus the water was slightly warmed. This operation was repeated several times, and the rise of temperature of the water was measured by means of a delicate thermometer. When corrections for friction, cooling, and other losses had been applied, Joule calculated that 772 foot-pounds of work were expended in raising 1 lb. of water 1° F. The experiment has been repeated in various forms, and the value now accepted for Joule's equivalent is 777.

Although energy cannot be destroyed, nor, it may be added, created, it may be rendered less available for use. The various forms of energy may be classified according to their availability, and in this respect mechanical energy is one of the most available, and low-temperature heat is one of the least available. The latter is therefore classed as a lower form of energy, and when energy is converted from a more available to a less available form, it is said to be dissipated or degraded. Now, during any transformation of energy, a part of the energy is spent in overcoming friction forces, and is thus degraded.

The problem of economizing our stores of energy is one which is now attracting more attention than it did formerly. With the greater scarcity of coal, and the future prospect of its complete absence, other natural sources of energy are being investigated. Oil has been discovered

in this country, but not in large quantities. Waterfalls have long been employed for driving mills wherever this type of power could be obtained cheaply and conveniently; the resources of the Highlands in this respect have not been utilized to any great extent. At Kinlochleven, where the valley has been dammed across to obtain sufficient water-power, an aluminium industry has sprung up. There is a scheme on foot at the present time to make use of the tidal energy of the Severn. Here and there windmills may be seen which drive water-pumps employed for draining purposes. On the Severn, near Ironbridge, a ferry is in use which employs the force of the river current to propel the ferry-boat across the river. In warmer countries batteries of mirrors have been employed to concentrate the sun's heat for use in the absence of fuel. In large towns the presence of unconsumed carbon (soot) in the atmosphere raises the question not only of fuel economy but also of public health.—BIBLIOGRAPHY: Kelvin and Tait, *Natural Philosophy*; Ralfour Stewart, *Conservation of Energy*; Deschanel, *Heat, Light, &c.*; R. Buckingham, *Thermodynamics*.

Enfantin (ân-fan-tan), Barthélemy Prosper, one of the chief founders of St. Simonism; born at Paris 1796, died in 1864. In 1825 he became acquainted with St. Simon, who in dying confided to him the task of continuing the work. This he did with success until after the Revolution of 1830, when, as the representative of the social and religious theories of the school, he quarrelled with Bazard, the representative of its political ideas. Enfantin organized model communities, which quickly fell to pieces; the new organ of the sect, *Le Globe*, was a failure; their convent at Ménilmontant, of which Enfantin was 'supreme father', was broken up by the Government (1832). He himself was imprisoned as an offender against public morality (being an advocate of free love), and on his release attempted to found a model colony in Egypt, which was broken up in the second year. He then retired to Tain (Drôme), where he lived for some time as a farmer. In 1841 he was sent as member of a commission to explore the industrial resources of Algiers, and on his return published a work on the *Colonization of Algiers* (1848). On the Revolution of 1848 he started a new journal, *Le Crédit Public*, but after two years withdrew from public notice. He afterwards held a post on the Lyons and Mediterranean Railway until his death. Among his works are: *Doctrine de St. Simon*, *La Religion St. Simonienne*.

En'field, a town, England, county Middlesex, 9 miles N. by E. London. It is the seat of the Government manufactory of rifles and small-arms. It gives its name to the British rifle

(Lee-Enfield), which helped to win the European War. Pop. 56,338.

Enfilade Fire, fire directed down the length of a trench or a line of troops from a point at right angles to their front. Its moral effect is very great, as it usually comes from an unexpected direction, and the target presented to it is generally more vulnerable. Trenches give much less protection against oblique or enfilade fire than they do against frontal fire, although the main purpose of 'bays' is to lessen the effect of enfilading.

En'gadine, a beautiful valley in Switzerland, in the Grisons, on the banks of the Inn, bordering on the Tyrol, about 50 miles long, but in some parts very narrow, divided into Upper and Lower. The pop. of the whole valley amounts to about 12,000. The language generally spoken is the Ladin, a branch of the Romanic tongue. The cold, dry climate and mineral springs have made the valley a favourite resort for invalids.

Engaged Column, in architecture, a column attached to a wall so that part of it (usually less than half) is concealed.

Engels, Friedrich, German Socialist, born at Barmen in 1820, died 1895. He was the son of a rich cotton-spinner, and although destined for a commercial career, he began to collaborate on the *Deutsch-Französische Jahrbücher* issued in Paris by Karl Marx and Arnold Ruge. He helped Marx to organize the Communist League in 1846, and took part in the Revolution of 1848 at Baden. From 1850 to 1860 he lived at Manchester as manufacturer. An intimate friend of Marx, he helped the latter to spread social democratic ideas, and was part author, of the *Communist Manifesto*. After the death of Marx he edited the second and third volumes of *Das Kapital*. Engel's own works include: *The Condition of the Working Classes in England in 1844*; *The Origin of the Family; Private Property and the State*; and *Socialism, Utopian and Scientific*.—Cf. Karl Kautsky, *Friedrich Engels: his Life, his Work, and his Writings*.

Enghien (ân-gi-ân), or Enguilen, a town in Hainault, Belgium, between Brussels and Tournai. It has a superb castle, and gave the title of duke to a prince of the house of Bourbon Condé in memory of the victory gained here by the great Condé. Pop. 4540.

Enghien (ân-gi-ân), Louis Antoine Henri de Bourbon, Duke of, born at Chantilly in 1772; son of Louis Henry Joseph Condé, Duke of Bourbon. On the outbreak of the Revolution he quitted France, travelled through various parts of Europe, and went in 1792 to Flanders to join his grandfather, the Prince of Condé, in the campaign against France. From 1796 to 1799 he commanded with distinguished merit the vanguard of Condé's army, which was disbanded

at the Peace of Lunéville (1801). He then took up residence as a private citizen at Kittenhelm in Baden, where he married the Princess Charlotte de Rohan Rochefort. He was generally looked upon as the leader of the *émigrés* (q.v.), and was suspected by the Bonapartists of complicity in the attempt of Cadoudal to assassinate the first consul. An armed force was sent to seize him in Baden in violation of all territorial rights, and he was brought to Vincennes on the 20th March, 1804. A trial, which was a mere form, was held the same night; and on the following morning he was shot in the ditch outside the walls. It was this event which drew from Fouché the comment, since become proverbial: "C'est plus qu'un crime, c'est une faute" ("It is worse than a crime, it is a blunder").

**En'gine.** See *Internal Combustion Engines*; *Steam-engines*.

**Engineering**, the profession concerned in applying the forces of nature to the service of man. It is divided into two groups, civil engineering and military engineering. This grouping of the profession of engineering is adopted in the Charter of the Institution of Civil Engineers. Army engineers are organized as Royal Engineers. Candidates intending to become Royal Engineer officers have to pass the Army Entrance Examination to gain admission to Woolwich. At Woolwich they receive a course of technical instruction, and then proceed to military engineering duties in the Royal Engineers. Naval engineers enter the service as naval cadets. The education of all naval cadets is the same, no matter in what branch of the service they may ultimately specialize, up to the rank of sub-lieutenant, when specialization begins. The engineering lieutenants undergo a special course of engineering training at the Royal Naval College, Greenwich, and then go to sea. Naval engineers are called upon to undergo a severe medical examination, as the conditions of service call for robust men.

In the ordinary way the term *civil engineering* is not used in the technical sense explained above, but is the name given to one of the sections into which the whole group is divided. The 'civil' engineer undertakes the design and erection of constructional works, such as harbours, docks, railways, buildings, bridges, &c. A person entering the profession of civil engineering usually receives a technical education at a technical school, or at a university, and then enters the office of a practising civil engineer. He will spend a part of his time at the drawing-board, learning the details of design, and a part of his time actually in the field or on works, assisting in the supervision of the work. The other departments of the group of 'civil engineers'—as distinct from military engineers—

are mechanical engineers, electrical engineers, motor engineers, telegraph engineers, radio engineers, mining engineers, aeronautical engineers, &c. With the exception of mining, the courses of training in these sections are very much the same, and consist of a technical course in a college or a university, followed by a practical training as a pupil in a works. The prior technical education is now being insisted upon by most of the large engineering firms, and, in many of the best works, special courses of instruction are given to apprentices as part of their training by the most experienced engineers of the company. In mining, the orthodox training consists of a technical course in one of the mining schools, followed by practical work in a mine. In this country every mining engineer who intends to take a position of responsibility must qualify by passing a Board of Trade examination. Sea-going marine engineering officers have, in addition to undergoing the usual training, to pass the sea-going engineers' examination of the Board of Trade. It will be seen from the above remarks that the courses of training for engineers depend entirely upon the particular branch of engineering which is to be entered. As this point is often not finally settled till fairly late in a young man's career, it is possibly unwise for him to take his initial training in too narrow a groove. A sound, general technical education, combined with three or four years' experience in a general engineering works, will fit him for specializing in very many sections of engineering, whereas if he intends to enter the mining or the civil engineering professions, a sound technical course, followed by a few years' experience in civil or mining engineering work abroad will usually fit him for a specialized post later on.

**Engineers, Royal.** Military engineers in one form or another, and under various names, have existed in England since the eleventh century. In those early days men of some education—often monks—were appointed as *Ingeniatores Regis* to undertake the manufacture of the king's engines of war, and to build his castles. In later years they became known as *Attillators*, and when, with the gradual introduction of gunpowder for military purposes, a combined train was formed, are considered to have given their name to what we now call artillery. In the early seventeenth century this train, composed of engineers and artillery, was merely a temporary corps raised for a particular war and disbanded on its conclusion; but in 1698, when the expediency of maintaining a standing army had been to some extent recognized, the first permanent train was raised. In 1716 a separate body of engineers was formed, but without military rank, and it was not till 1792 that mili-

tary titles were conferred on the officers of engineers. In 1787 the Corps of Engineers became by Royal Warrant the Corps of Royal Engineers, with the mottoes *Ubique* and *Quo fas et gloria ducunt*, which are also borne by the Royal Regiment of Artillery. For a considerable period the rank and file of the corps were known as the 'Royal Sappers and Pioneers', and the term 'Sapper' is still used to denote a private of the corps. Among the present-day peace-time duties of the Royal Engineers are the construction and maintenance of barracks and military works generally, while for war purposes the corps is organized into mobile units known as field squadrons and companies for general field-work, and into more highly specialized units for mining, heavy bridging, and railway work. The corps is recruited almost entirely from among artisans and tradesmen, and a field company of a total strength of 184 all ranks has representatives of no fewer than nineteen trades in it.

England, including *Wales*, the southern and larger portion of the Island of Great Britain, is situated between  $50^{\circ}$  and  $55^{\circ} 40'$  N. lat., and  $1^{\circ} 40'$  E. and  $5^{\circ} 42'$  W. long. On the north it is bounded by Scotland; on all other sides it is washed by the sea: on the east by the North Sea; on the south by the English Channel; and on the west by St. George's Channel and the Irish Sea. Its figure is, roughly speaking, triangular, but with many windings and indentations, the coast-line measuring not less than 2765 miles. The length of the country, measured on a meridian from Berwick nearly to St. Alban's Head, is 365 miles. Its breadth, measured on a parallel of latitude, attains its maximum between St. David's Head, in South Wales, and the Naze, in Essex, where it amounts to 280 miles. The area is 37,340,368 acres or 58,310 sq. miles, of which 32,559,868 acres or 50,874 sq. miles are in England, and 4,780,470 acres or 7466 sq. miles in Wales. This is exclusive of the Channel Islands and the Isle of Man, which together would add 193,047 acres or 302 sq. miles more to the area. The subdivision of Eng-

land into shires or counties does not appear to have assumed a definite form till the time of Alfred. The existing division was first completed under Henry VIII. There are now 'administrative counties' and 'registration counties', differing in area from the old counties; London



being now a county. The figures in the table (p. 241) refer to the old counties.

The capital of England and of the British Empire is London. The cities next in size (in order of population) are: Liverpool, Manchester and Salford, Birmingham, Leeds, Sheffield, Bristol, Bradford, Nottingham, and Hull.

*Physical Features.*—The chief indentations are: on the east, the Humber, the Wash, and the Thames estuary; on the west, the Solway Firth,

Morecambe Bay, Cardigan Bay, and the Bristol Channel; those on the south are less prominent, though including some useful harbours. The greater part of the coast consists of cliffs, in some places clayey, in others rocky, and sometimes jutting out, as at Whitby and Flamborough Head

on the east coast; the Isle of Wight on the south; the Scilly Isles at the south-west extremity; and Lundy Island, Anglesey, Holy Island, and Walney on the west.

The loftiest heights of England and Wales are situated at no great distance from its western

shores, and consist not so much of a continuous chain as of a succession of mountains and hills stretching, with some interruptions, from north to south, and throwing out numerous branches on both sides, but particularly to the west, where all the culminating summits are found. The northern portion of this range has received the name of the Pennine chain. It is properly a continuation of the Cheviot Hills, and, commencing at the Scottish border, proceeds south for about 270 miles till, in the counties of Derby and Stafford, it assumes the form of an elevated moorland plateau. In Derbyshire The Peak rises to the height of 2080 feet. By far the most important of its offshoots are those of the west, more especially if we include in them the lofty mountain masses in North-Western England sometimes classed separately as the Cumbrian range. Amidst these mountains lie the celebrated English lakes, of which the most important are Windermere, Derwent Water, Conistone Lake, and Ullswater. Here also is the highest summit of Northern England, Snowdon (3571 feet). The Pennine chain, with its appended Cumbrian range, is succeeded by one which surpasses both these in loftiness and extent, but has its great nucleus much farther to the west, where it covers the greater part of Wales, deriving from this



on the east, Benchy Head, the Isle of Portland, the Lizard and Land's End on the south and south-west, St. David's Head and St. Bees Head on the west, into bold, lofty, and precipitous headlands. The most extensive stretches of flat coast are on the east, in the county of Lincoln, and from the southern part of Suffolk to the South Foreland in Kent, and in Sussex and Hants on the south coast. The chief islands are: Holy Island, the Farne Islands, Sheppey, and Thanet

its name, the Cambrian range. Its principal ridge stretches through Carnarvonshire from N.N.E. to S.S.W., with Snowdon (3571 feet) as the culminating point of South Britain. Across the Bristol Channel from Wales is the Devonian range. It may be considered as commencing in the Mendip Hills of Somerset, and then pursuing a south-westerly direction through that county and the counties of Devon and Cornwall to the Land's End, the wild and desolate tract of Dartmoor

	Area in Statute Acres, 1921 (Land and Inland Water) Counties, including County Boroughs	Census Population. Counties, including County Boroughs, 1911	Census Population. Counties, including County Boroughs, 1921
<b>ENGLAND.</b>			
Bedfordshire .. .. .	302,942	194,588	206,478
Berkshire .. .. .	463,830	280,794	294,807
Buckinghamshire .. .. .	479,360	219,551	236,209
Cambridgeshire .. .. .	315,168	128,322	129,594
Isle of Ely .. .. .	238,073	69,752	73,778
Cheshire .. .. .	657,950	954,779	1,025,423
Cornwall .. .. .	868,167	328,008	320,550
Cumberland .. .. .	973,080	265,746	273,037
Derbyshire .. .. .	650,369	683,423	714,539
Devonshire .. .. .	1,671,164	699,703	709,488
Dorsetshire .. .. .	625,612	223,266	228,258
Durham .. .. .	649,244	1,369,800	1,478,506
Essex .. .. .	979,532	1,350,881	1,468,341
Gloucestershire .. .. .	805,842	736,097	757,668
Hampshire .. .. .	538,924	114,269	113,118
Hertfordshire .. .. .	404,523	311,284	333,236
Huntingdonshire .. .. .	233,985	55,577	54,748
Kent .. .. .	975,965	1,045,591	1,141,867
Lancashire .. .. .	1,194,555	4,767,832	4,928,359
Leicestershire .. .. .	532,779	476,553	494,522
Lincolnshire .. .. .			
The parts of Holland .. .. .	263,355	82,849	85,225
The parts of Kesteven .. .. .	469,142	111,324	108,237
The parts of Lindsey .. .. .	972,796	369,787	408,643
London .. .. .	74,850	4,521,685	4,483,249
Middlesex .. .. .	148,692	1,126,465	1,253,164
Monmouthshire .. .. .	349,552	395,719	450,700
Norfolk .. .. .	1,315,064	499,116	504,277
Northamptonshire .. .. .	585,145	303,797	302,430
Soke of Peterborough .. .. .	53,464	44,718	46,954
Northumberland .. .. .	1,201,415	696,893	746,138
Nottinghamshire .. .. .	540,123	604,098	641,134
Oxfordshire .. .. .	479,220	189,484	189,556
Rutlandshire .. .. .	97,273	20,346	18,368
Shropshire .. .. .	861,800	246,307	242,950
Somersetshire .. .. .	1,037,394	458,025	465,682
Southampton .. .. .	958,896	862,393	910,333
Isle of Wight .. .. .	94,146	88,186	94,697
Staffordshire .. .. .	741,318	1,279,649	1,349,225
Suffolk, East .. .. .	577,353	277,155	261,006
Suffolk, West .. .. .	390,916	116,905	108,082
Surrey .. .. .	461,833	845,578	930,377
Sussex, East .. .. .	539,555	487,070	532,206
Sussex, West .. .. .	401,916	176,308	195,795
Warwickshire .. .. .	605,275	1,247,418	1,390,092
Westmorland .. .. .	504,017	63,575	65,740
Wiltshire .. .. .	804,101	286,822	292,213
Worcestershire .. .. .	458,352	387,688	405,876
Yorkshire, East Riding .. .. .	759,114	432,759	460,717
" North Riding .. .. .	1,362,058	419,546	456,312
" West Riding .. .. .	1,773,529	3,045,377	3,181,654
Totals .. .. .	32,559,868	34,045,290	35,678,530
<b>WALES</b>			
Anglesey .. .. .	176,630	50,028	51,665
Brecknockshire .. .. .	469,281	59,287	61,257
Cardiganshire .. .. .	443,189	59,879	61,292
Carmarthenshire .. .. .	588,472	160,406	175,069
Carmarvonshire .. .. .	366,004	125,043	131,034
Denbighshire .. .. .	426,080	144,783	154,847
Flintshire .. .. .	163,707	92,795	106,466
Glamorganshire .. .. .	520,456	1,120,910	1,252,761
Merionethshire .. .. .	422,372	45,565	45,450
Montgomeryshire .. .. .	510,110	53,146	51,317
Pembrokeshire .. .. .	393,093	80,960	82,050
Radnorshire .. .. .	301,165	22,590	23,528
Totals, Wales (12 counties) .. .. .	4,780,470	2,025,202	2,206,712
Totals, England and Wales .. .. .	37,340,338	36,070,492	37,885,242

forming one of its most remarkable features north-easterly direction from near the Mendip (highest summit, Yes Tor, 2050 feet). Other Hills; the Chiltern Hills taking a similar direction ranges are the Cotswold Hills proceeding in a farther to the east; and the North and South

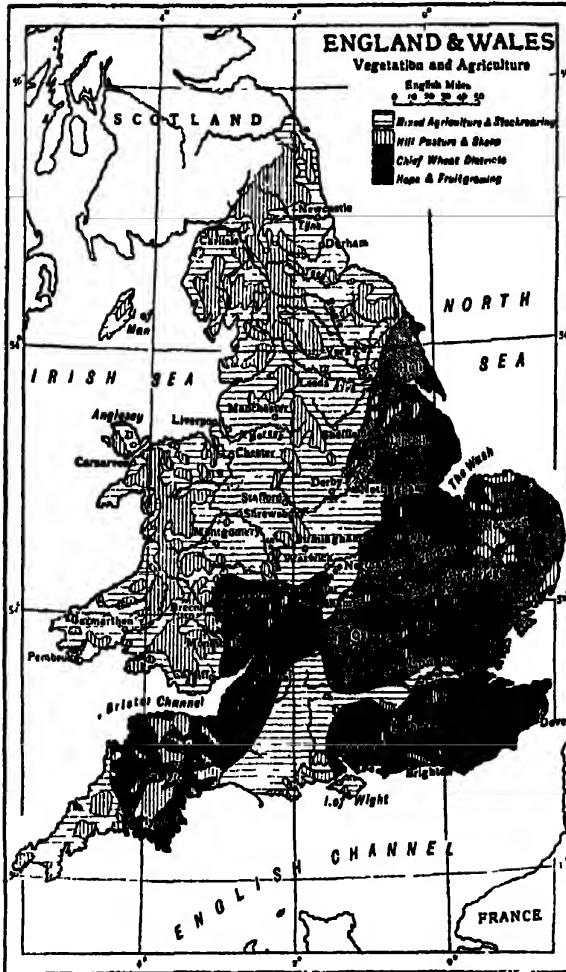


Downs running eastward, the latter reaching the south coast near Beachy Head, the former reaching the south-east coast at Folkestone.

A large part of the surface of England consists of wide valleys and plains. Beginning in the north, the first valleys on the east side are

counties of Lincoln, Suffolk, and Essex, to the mouth of the Thames, and to a considerable distance inland, comprising the Central Plain and the region of the Fens. On the west side of the island, in South Lancashire and Cheshire, is the fertile Cheshire Plain. In Wales there are

no extensive plains, the valleys generally having a narrow rugged form favourable to romantic beauty, but not compatible with great fertility. Wales, however, by giving rise to the Severn, can justly claim part in the vale, or series of almost unrivalled vales, along which it pursues its romantic course through the counties of Montgomery, Salop, Worcester, and Gloucester. South-east of the Cotswold Hills is Salisbury Plain, but it is only in name that it can be classed with the other plains and level lands of England, being a large elevated plateau, of an oval shape, with a thin chalky soil only suitable for pasture. In the south-west the only vales deserving of notice are those of Taunton in Somerset and Exeter in Devon. A large portion of the south-east may be regarded as a continuous plain, consisting of what are called the Wealds of Sussex, Surrey, and Kent, between the North and South Downs, and containing an area of about 1000 sq. miles. The south-east angle of this district is occupied by the Romney Marsh, an extensive level tract composed for the most part of a rich marine deposit. Extensive tracts of a similar nature are situated on the east coast, in Yorkshire and Lincoln, where they are washed by the Humber; and in the counties which either border the Wash, or, like Northampton, Bedford, Huntingdon, and Cambridge, send their drain-



those of the Coquet, Tyne, and Tees; on the west the beautiful valley of the Eden, which, at first hemmed in between the Cumbrian range and Pennine chain, gradually widens out into a plain of about 470 sq. miles, with the town of Carlisle in its centre. The most important of the northern plains is the Vale of York, which has an area of nearly 1000 sq. miles. Properly speaking it is still the same plain which stretches, with scarcely a single interruption, across the

age into it by the Nene and the Ouse. Many of these lands are naturally the richest in the kingdom, but have been utilized only by means of drainage.

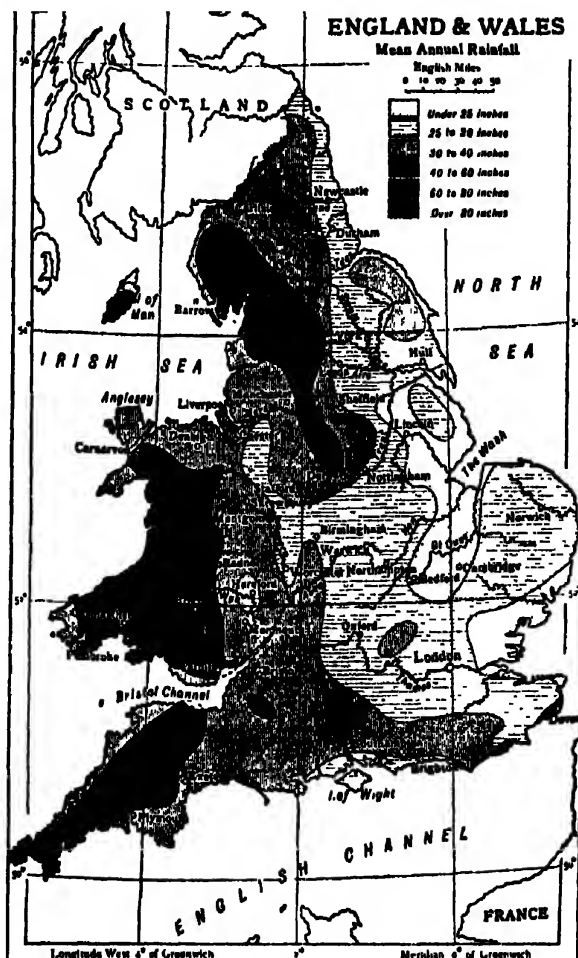
England is well supplied with rivers, many of them of great importance to industry and commerce. Most of them carry their waters to the North Sea. If we consider the drainage as a whole, four principal river basins may be distinguished, those of the Thames, Wash, and

Humber belonging to the North Sea; and the Severn belonging to the Atlantic. The basin of the Thames has its greatest length from east to west, 180 miles, and its average breadth about 50 miles, area 6160 sq. miles. The river itself, which is the chief of English rivers, has a length of 215 miles. The basin of the Wash consists of the subordinate basins of the Great Ouse, Nene, Welland, and Witham, which all empty themselves into that estuary, and has an area computed at 5850 sq. miles. The basin of the Severn consists of two distinct portions, that on the right bank, of an irregularly oval shape, and having for its principal tributaries the Teme and the Wye; and that on the left, of which the Upper Avon is the principal tributary stream. The area of the whole basin is 8580 sq. miles. The next basin, that of the Humber, the largest of all, consists of the three basins of the Humber proper, the Ouse, and the Trent, and its area is 9550 sq. miles, being about one-sixth of the whole area of England and Wales. Other rivers unconnected with these systems are the Tyne, Wear, and Tees in the north-east; the Eden, Ribbles, Mersey, and Dee in the north-west. The south-coast streams are very unimportant except for their estuaries.

For the minerals, climate, agriculture, manufactures, &c., of England, see the article *Britain*.

**Civil History.**—The history of England proper begins when it ceased to be a Roman possession. (See *Britain*.) On the withdrawal of the Roman forces, about the beginning of the fifth century A.D., the South Britons, or inhabitants of what is now called England, were no longer able to withstand the attacks of their ferocious northern neighbours, the Scots and Picts. They applied for assistance to Aëtius, but the Roman general was too much occupied in the struggle with Attila to attend to their petition. In their distress they appear to have sought the aid of the Saxons; and according to the Anglo-Saxon narratives three ships, containing 1000 men, were dispatched to their help under the command

of the brothers Hengist and Horsa. Vortigern, a duke or prince of the Britons, assigned them the Isle of Thanet for habitation, and, marching against the northern foe, they obtained a complete victory. The date assigned to these events by the later Anglo-Saxon chronicles is A.D. 449,

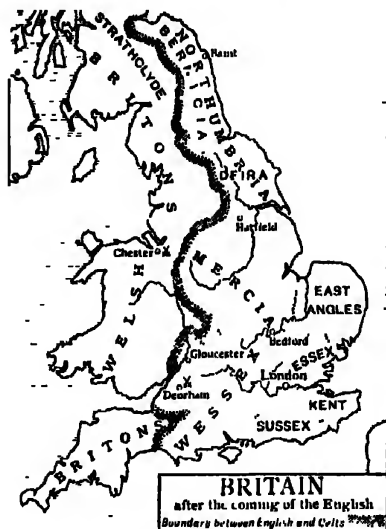


the narratives asserting further that the Saxons, finding the land desirable, turned their arms against the Britons, and, reinforced by new bands, conquered first Kent and ultimately the larger part of the island. Whatever the credibility of the story of Vortigern, it is certain that in the middle of the fifth century the occasional Teutonic incursions gave place to persistent invasion with a view to settlement. These Teutonic invaders were Low German tribes from the

country about the mouths of the Elbe and the Weser, the three most prominent being the Angles, the Saxons, and the Jutes. Of these the Jutes were the first to form a settlement, taking possession of part of Kent and the Isle of Wight; but the larger conquests of the Saxons in the south and the Angles in the north gave to these tribes the leading place in the kingdom. The struggle continued 150 years, and at the end of that period the whole southern part of Britain, with the exception of Strathclyde, Wales, and West Wales (Cornwall), was in the hands of the Teutonic tribes. This conquered territory was divided among a number of small states or petty chieftaincies, seven of the most conspicuous of which are often spoken of as the *Heptarchy*. These were: 1. The kingdom of Kent; founded by Hengist in 455; ended in 823. 2. Kingdom of South Saxons, containing Sussex and Surrey; founded by Ella in 477; ended in 689. 3. Kingdom of East Angles, containing Norfolk, Suffolk, Cambridge, Ely (Isle of); founded by Uffa in 571 or 575; ended in 792. 4. Kingdom of West Saxons, containing Devon, Dorset, Somerset, Wilts, Hants, Berks, and part of Cornwall; founded by Cerdic 519; swallowed up the rest in 827. 5. Kingdom of Northumbria, containing York, Durham, Cumberland, Westmorland, Northumberland, and the east coast of Scotland to the Firth of Forth; founded by Ida 547; absorbed by Wessex in 827. 6. Kingdom of East Saxons, containing Essex, Middlesex, Hertford (part); founded by Erchew in 527; ended in 823. 7. Kingdom of Mercia, containing Gloucester, Hereford, Worcester, Warwick, Leicester, Rutland, Northampton, Lincoln, Huntingdon, Bedford, Buckingham, Oxford, Stafford, Derby, Salop, Nottingham, Chester, Hertford (part); founded by Cridda about 584; absorbed by Wessex in 827. Each state was, in its turn, annexed to more powerful neighbours; and at length, in 827, Egbert, by his valour and superior capacity, united in his own person the sovereignty of what had formerly been seven kingdoms, and the whole came to be called Engla-land, that is Anglo-land.

While this work of conquest and of intertribal strife had been in progress towards the establishment of a united kingdom, certain important changes had occurred. The conquest had been the slow expulsion of a Christian race by a purely heathen race, and the country had returned to something of its old isolation with regard to the rest of Europe. But before the close of the sixth century Christianity had secured a footing in the south-east of the island. Ethelberht, King of Kent and suzerain over the kingdoms south of the Humber, married a Christian wife, Bertha, daughter of Charibert of Soissons, and this event indirectly led to the coming of

St. Augustine. The conversion of Kent, Essex, and East Anglia was followed by that of Northumberland and then by that of Mercia, of Wessex, of Sussex, and lastly of Wight, the contest between the two religions being at its height in the seventh century. The legal and political changes immediately consequent upon the adoption of Christianity were not great, but there resulted a more intimate relation with Europe and the older civilizations, the introduction of new learning and culture, the formation of a written literature, and the fusion of the tribes and petty kingdoms into a closer



and more lasting unity than that which could have been otherwise secured.

The kingdom, however, was still kept in a state of disturbance by the attacks of the Danes, who had made repeated incursions during the whole of the Saxon period, and about half a century after the unification of the kingdom became for the moment masters of nearly the whole of England. But the genius of Alfred the Great, who had ascended the throne in 871, speedily reversed matters by the defeat of the Danes at Edinburg (878). Guthrum, their king, embraced Christianity, became the vassal of the Saxon king, and retired to a strip of land on the east coast including Northumbria and called the Danelagh. The two immediate successors of Alfred, Edward (901-925) and Athelstan (925-940), the son and the grandson of Alfred, both vigorous and able rulers, had each in turn to direct his arms against these settlers of the Danelagh. The reigns of the next five kings, Edmund, Edred, Edwy, Edgar, and

Edward the Martyr, are chiefly remarkable on account of the conspicuous place occupied in them by Dunstan, who was counsellor to Edmund, minister of Eadred, treasurer under Edwy, and supreme during the reigns of Edgar and his successor. It was possibly due to his policy that from the time of Athelstan till after the death of Edward the Martyr (978 or 979) the country had comparative rest from the Danes. During the tenth century many changes had taken place in the Teutonic constitution. Feudalism was already taking root; the king's authority had increased; the folkland was being taken over as the king's personal property; the nobles by birth, or ealdormen, were becoming of less importance in administration than the nobility of thegns, the officers of the king's court. Ethelred (978-1016), who succeeded Edward, was a minor, the government was feebly conducted, and no united action being taken against the Danes, their incursions became more frequent and destructive. Animositities between the English and the Danes who had settled among them became daily more violent, and a general massacre of the latter took place in 1002. The following year Sweyn invaded the kingdom with a powerful army and assumed the crown of England. Ethelred was compelled to take refuge in Normandy; and though he afterwards returned, he found in Canute an adversary no less formidable than Sweyn. Ethelred left his kingdom in 1016 to his son Edmund, who displayed great valour, but was compelled to divide his kingdom with Canute; and when he was assassinated in 1017 the Danes succeeded to the sovereignty of the whole.

Canute (Knut), who espoused the widow of Ethelred, that he might reconcile his new subjects, obtained the name of Great, not only on account of his personal qualities, but from the

extent of his dominions, being master of Denmark and Norway as well as England. In 1035 he died, and was followed in England by two other Danish kings, Harold and Hardicanute, whose joint reigns lasted till 1042, after which the English line was again restored in the



person of Edward the Confessor. Edward was a weak prince, and in the latter years of his reign had far less real power than his brother-in-law Harold, son of the great Earl Godwin. On Edward's death in 1066 Harold accordingly obtained the crown. He found, however, a formidable opponent in the second-cousin of Edward, William of Normandy, who instigated

the Danes to invade the northern counties, while he, with 60,000 men, landed in the south. Harold vanquished the Danes, and hastening southwards met the Normans near Hastings, at Senlac, afterwards called Battle. Harold and his two brothers fell (14th Oct., 1066), and William (1066-87) immediately claimed the government as lawful King of England, being subsequently known as William I, the Conqueror. For some time he conducted the government with great moderation; but being obliged to reward those who had assisted him, he bestowed the chief offices of government upon Normans, and divided among them a great part of the country. The revolts of the native English which followed were quickly crushed, Continental feudalism in a modified form was established, and the English Church reorganized under Lanfranc as Archbishop of Canterbury.

At his death, in 1087, William II, commonly known by the name of Rufus, the Conqueror's second son, obtained the crown, Robert, the eldest son, receiving the duchy of Normandy. In 1100, when William II was accidentally killed in the New Forest, Robert was again cheated of his throne by his younger brother Henry (Henry I), who in 1106 even wrested from him the duchy of Normandy. Henry's power being secured, he entered into a dispute with Anselm the Primate, and with the Pope, concerning the right of granting investiture to the clergy. He supported his quarrel with firmness, and brought it to a not unfavourable issue. His reign was also marked by the suppression of the greater Norman nobles in England, whose power (like that of many Continental feudatories) threatened to overshadow that of the king, and by the substitution of a class of lesser nobles. In 1135 he died in Normandy, leaving behind him only a daughter, Matilda.

By the will of Henry I his daughter Maud or Matilda, wife of Geoffrey Plantagenet, Count of Anjou, and frequently styled the Empress Matilda, because she had first been married to Henry V, Emperor of Germany, was declared his successor. But Stephen, son of the Count of Blois, and of Adela, daughter of William the Conqueror, raised an army in Normandy, landed in England, and declared himself king. After years of civil war and bloodshed an amicable arrangement was brought about, by which it was agreed that Stephen should continue to reign during the remainder of his life, but that he should be succeeded by Henry, son of Matilda and the Count of Anjou. Stephen died in 1154, and Henry Plantagenet ascended the throne with the title of Henry II, being the first of the Plantagenet or Angevin kings. A larger dominion was united under his sway than had been held by any previous sovereign of England,

for at the time when he became King of England he was already in the possession of Anjou, Normandy, and Aquitaine.

Henry II found far less difficulty in restraining the licence of his barons than in abridging the exorbitant privileges of the clergy, who claimed exemption not only from the taxes of the State, but also from its penal enactments, and who were supported in their demands by the Primate Becket. The king's wishes were formulated in the Constitutions of Clarendon (1164), which were at first accepted and then repudiated by the Primate. The assassination of Becket, however, placed the king at a disadvantage in the struggle, and after his conquest of Ireland (1171) he submitted to the Church, and did penance at Becket's tomb. Henry was the first who placed the common people of England in a situation which led to their having a share in the Government. The system of frankpledge was revived, trial by jury was instituted by the Assize of Clarendon, and the Eyre courts were made permanent by the Assize of Nottingham. To curb the power of the nobles he granted charters to towns, freeing them from all subjection to any but himself, thus laying the foundation of a new order in society.

Richard I, called Cœur de Lion, who in 1189 succeeded to his father, Henry II, spent most of his reign away from England. Having gone to Palestine to join in the third crusade, he proved himself an intrepid soldier. Returning homewards in disguise through Germany, he was made prisoner by Leopold, Duke of Austria, but was ransomed by his subjects. In the meantime John, his brother, had aspired to the crown, and hoped, by the assistance of the French, to exclude Richard from his right. Richard's presence for a time restored matters to some appearance of order; but having undertaken an expedition against France, he received a mortal wound at the siege of Châlons, in 1199.

John was at once recognized as King of England, and secured possession of Normandy; but Anjou, Maine, and Touraine acknowledged the claim of Arthur, son of Geoffrey, second son of Henry II. On the death of Arthur, while in John's power, these four French provinces were at once lost to England. John's opposition to the Pope in electing a successor to the see of Canterbury in 1205 led to the kingdom being placed under an *Interdict*; and, the nation being in a disturbed condition, he was at last compelled to receive Stephen Langton as archbishop, and to accept his kingdom as a fief of the papacy (1213). His exactions and misgovernment had equally embroiled him with the nobles. In 1213 they refused to follow him to France, and, on his return defeated, they at once took measures to secure their own privileges and abridge

the prerogatives of the Crown. King and barons met at Runnymede, and on 15th June, 1215, the Great Charter (*Magna Charta*) was signed. It was speedily declared null and void by the Pope, and war broke out between John and the barons, who were aided by the French king. In 1216, however, John died, and his turbulent reign was succeeded by the almost equally turbulent reign of his son Henry III.

During the first years of the reign of Henry III the abilities of the Earl of Pembroke, who was regent until 1219, retained the kingdom in tranquillity; but when, in 1227, Henry assumed the reins of government he showed himself incapable of managing them. The Charter was three times reissued in a modified form, and new privileges were added to it, but the king took no pains to observe its provisions. The struggle, long maintained in the Great Council (henceforward called Parliament) over money grants and other grievances, reached an acute stage in 1263, when civil war broke out. Simon de Montfort, who had laid the foundations of the House of Commons by summoning representatives of the shire communities to the Mad Parliament of 1258, had by this time engrossed the sole power. He defeated the king and his son Edward at Lewes in 1264, and in his famous Parliament of 1265 still further widened the privileges of the people by summoning to it burgesses as well as knights of the shire. The escape of Prince Edward, however, was followed by the battle of Evesham (1265), at which Earl Simon was defeated and slain, and the rest of the reign was undisturbed.

On the death of Henry III, in 1272, Edward I succeeded without opposition. From 1276 to 1284 he was largely occupied in the conquest and annexation of Wales, which had become practically independent during the barons' wars. In 1292 Baliol, whom Edward had decided to be rightful heir to the Scottish throne, did homage for the fief to the English king; but when, in 1294, war broke out with France, Scotland also declared war. The Scots were defeated at Dunbar (1296), and the country placed under an English regent; but the revolt under Wallace (1297) was followed by that of Bruce (1306), and the Scots remained unsubdued. The reign of Edward was distinguished by many legal and legislative reforms, such as the separation of the old king's court into the Court of Exchequer, Court of King's Bench, and Court of Common Pleas, and the passage of the Statute of Mortmain. In 1295 the first perfect Parliament was summoned, the clergy and barons by special writ, the commons by writ to the sheriffs directing the election of two knights from each shire, two citizens from each city, two burghers from each borough. Two years later the imposition of taxation without consent of Parliament was

forbidden by a special Act (*De Tallagio non Concedendo*). The great aim of Edward, however, to include England, Scotland, and Wales in one kingdom proved a failure, and he died in 1307 marching against Robert Bruce.

The reign of his son Edward II was unfortunate to himself and to his kingdom. He made a feeble attempt to carry out his father's last and earnest request to prosecute the war with Scotland, but the English were almost constantly unfortunate; and at length, at Bannockburn (1314), they were defeated by Robert Bruce, which ensured the independence of Scotland. The king soon proved incapable of regulating the lawless conduct of his barons; and his wife, a woman of a bold, intriguing disposition, joined in the confederacy against him, which resulted in his imprisonment and death in 1327.

The reign of Edward III was as brilliant as that of his father had been the reverse. The main projects of the third Edward were directed against France, the crown of which he claimed in 1328 in virtue of his mother, the daughter of King Philip. The victory won by the Black Prince at Crécy (1346), the capture of Calais (1347), and the victory of Poitiers (1356), ultimately led to the Peace of Brétigny in 1360, by which Edward III received all the west of France on condition of renouncing his claim to the French throne. (See *Brétigny*.) Before the close of his reign, however, these advantages were all lost again, save a few principal towns on the coast.

Edward III was succeeded in 1377 by his grandson Richard II, son of Edward the Black Prince. The people of England now began to show, though in a turbulent manner, that they had acquired just notions of government. In 1380 an unjust and oppressive poll-tax brought their grievances to a head, and 100,000 men, under Wat Tyler, marched towards London (1381). Wat Tyler was killed while conferring with the king, and the prudence and courage of Richard appeased the insurgents. Despite his conduct on this occasion, Richard was deficient in the vigour necessary to curb the lawlessness of the nobles. In 1398 he banished his cousin, Henry Bolingbroke; and on the death of the latter's father, the Duke of Lancaster, unjustly appropriated his cousin's patrimony. To avenge the injustice Bolingbroke landed in England during the king's absence in Ireland, and at the head of 60,000 malcontents compelled Richard to surrender. He was confined in the Tower, and despite the superior claims of Edmund Mortimer, Earl of March, Henry was appointed king (1399), the first of the House of Lancaster. Richard was, in all probability, murdered early in 1400.

The manner in which the Duke of Lancaster,

now Henry IV, acquired the crown rendered his reign extremely turbulent, but the vigour of his administration quelled every insurrection. The most important—that of the Percies of Northumberland, Owen Glendower, and Douglas of Scotland—was crushed by the battle of Shrewsbury (1403). During the reign of Henry IV the clergy of England first began the practice of burning heretics under the Act *de hæretico comburendo*, passed in the second year of his reign. The Act was chiefly directed against the Lollards, as the followers of Wycliffe now came to be called. Henry died in 1413, leaving his crown to his son, Henry V, who revived the claim of Edward III to the throne of France in 1415, and invaded that country at the head of 30,000 men. The disjointed councils of the French rendered their country an easy prey; the victory of Agincourt was gained in 1415; and after a second campaign a peace was concluded at Troyes in 1420, by which Henry received the hand of Katherine, daughter of Charles VI, was appointed regent of France during the reign of his father-in-law, and declared heir to the throne on his death. The two kings, however, died within a few weeks of each other in 1422, and the infant son of Henry thus became King of England (as Henry VI) and France at the age of nine months.

England, during the reign of Henry VI, was subjected, in the first place, to all the confusion incident to a long minority, and afterwards to all the misery of a civil war. Henry allowed himself to be managed by anyone who had the courage to assume the conduct of his affairs, and the influence of his wife, Margaret of Anjou, a woman of uncommon capacity, was of no advantage either to himself or the realm. In France (1422–53) the English forces lost ground, and were finally expelled by the celebrated Joan of Arc, Calais alone being retained. The rebellion of Jack Cade in 1450 was suppressed, only to be succeeded by more serious trouble. In that year Richard, Duke of York, the father of Edward, afterwards Edward IV, began to advance his pretensions to the throne, which had been so long usurped by the House of Lancaster. His claim was founded on his descent from the third son of Edward III, Lionel, Duke of Clarence, who was his great-great-grandfather on the mother's side, while Henry was the great-grandson on the father's side of John of Gaunt, Duke of Lancaster, the fourth son of Edward III. Richard of York was also grandson on the father's side of Edmund, fifth son of Edward III. The wars which resulted, called the Wars of the Roses, from the fact that a red rose was the badge of the House of Lancaster and a white one that of the House of York, lasted for thirty years, from the first battle of St. Albans, 22nd

May, 1455, to the battle of Bosworth, 22nd Aug., 1485. Henry VI was twice driven from the throne (in 1461 and 1471) by Edward of York, whose father had previously been killed in battle in 1460. Edward of York reigned as Edward IV from 1461 till his death in 1483, with a brief interval in 1471; and was succeeded by two other sovereigns of the House of York, first his son Edward V, who reigned for eleven weeks in 1483; and then by his brother Richard III, who reigned from 1483 till 1485, when he was defeated and slain on Bosworth field by Henry Tudor, of the House of Lancaster, who then became Henry VII.

Henry VII was at this time the representative of the House of Lancaster, and in order at once to strengthen his own title, and to put an end to the rivalry between the Houses of York and Lancaster, he married, in 1486, Elizabeth, the sister of Edward V and heiress of the House of York. His reign was disturbed by insurrections attending the impostures of Lambert Simnel (1487), who pretended to be a son of the Duke of Clarence, brother of Edward IV, and of Perkin Warbeck (1488), who affirmed that he was the Duke of York, younger brother of Edward V; but neither of these attained any magnitude. The king's worst fault was the avarice which led him to employ in schemes of extortion such instruments as Empson and Dudley. His administration throughout did much to increase the royal power and to establish order and prosperity. He died in 1509.

The authority of the English Crown, which had been so much extended by Henry VII, was by his son Henry VIII exerted in a tyrannical and capricious manner. The most important event of the reign was undoubtedly the Reformation; though it had its origin rather in Henry's caprice and in the casual situation of his private affairs than in his conviction of the necessity of a reformation in religion, or in the solidity of reasoning employed by the reformers. Henry had been enoused to Catherine of Spain, who was first married to his elder brother Arthur, a prince who died young. Henry became disgusted with his queen, and enamoured of one of her maids of honour, Anne Boleyn. He had recourse, therefore, to the Pope to dissolve a marriage which had at first been rendered legal only by a dispensation from the Pontiff; but, failing in his desires, he broke away entirely from the Holy See, and in 1534 got himself recognized by Act of Parliament as the head of the English Church. He died in 1547. He was married six times, and left three children, each of whom reigned in turn. These were: Mary, by his first wife, Catherine of Aragon; Elizabeth, by his second wife, Anne Boleyn; and Edward, by his third wife, Jane Seymour.



Edward, who reigned first, with the title of Edward VI, was nine years of age at the time of his succession, and died in 1553, when he was only sixteen. His short reign, or rather the reign of the Earl of Hertford, afterwards Duke of Somerset, who was appointed regent, was distinguished chiefly by the success which attended the measures of the reformers, who acquired great part of the power formerly engrossed by the Catholics. The intrigues of Dudley, Duke of Northumberland, during the reign of Edward, caused Lady Jane Grey to be declared his successor; but her reign, if it could be called such, lasted only a few days. Mary, daughter of Henry VIII, was placed upon the throne, and Lady Jane Grey and her husband were both executed. Mary, a bigoted Catholic, seems to have wished for the crown only for the purpose of re-establishing the Roman Catholic faith. Political motives had induced Philip of Spain to accept of her as a spouse; but she could never prevail on her subjects to allow him any share of power. She died in 1558.

Elizabeth, who succeeded her sister Mary, was attached to the Protestant faith, and found little difficulty in establishing it in England. Having concluded peace with France (1559), Elizabeth set herself to promote the confusion which prevailed in Scotland, to which her cousin Mary had returned from France as queen in 1561. In this she was so far successful that Mary placed herself in her power (1568), and after many years imprisonment was sent to the scaffold (1587). As the most powerful Protestant nation, and as a rival to Spain in the New World, it was natural that England should become involved in difficulties with that country. The dispersion of the Armada by the English fleet under Howard, Drake, and Hawkins was the most brilliant event of a struggle which abounded in minor feats of valour. In Elizabeth's reign London became the centre of the world's trade, the extension of British commercial enterprise being coincident with the ruin of Antwerp in 1585. The Parliament was increased by the creation of sixty-two new boroughs, and its members were exempted from arrest. In literature not less than in politics and in commerce the same full life displayed itself, and England began definitely to assume the characteristics which distinguish her from the other European nations of to-day.

To Elizabeth succeeded (in 1603) James VI of Scotland and I of England, son of Mary Queen of Scots and Darnley. His accession to the crown of England in addition to that of Scotland did much to unite the two nations, though a certain smouldering animosity still lingered. His dissimulation, however, ended in his satisfying neither of the contending ecclesiastical parties—

the Puritans or the Catholics; and his absurd insistence on his divine right made his reign a continuous struggle between the prerogative of the Crown and the freedom of the people. His extravagance kept him in constant disputes with the Parliament, who would not grant him the sums he demanded, and compelled him to resort to monopolies, loans, benevolences, and other illegal methods. The nation at large, however, continued to prosper through the whole of his reign. His son Charles I, who succeeded him in 1625, inherited the same exalted ideas of royal prerogative, and his marriage with a Catholic, his arbitrary rule, and illegal methods of raising money provoked bitter hostility. Under the guidance of Laud and Strafford things went from bad to worse. Civil war broke out in 1642 between the king's party and that of the Parliament, and the latter proving victorious, in 1649 the king was beheaded.

A Commonwealth or republican government was now established, in which the most prominent figure was Oliver Cromwell. Mutinies in the army among Fifth-monarchists and Levellers were subdued by Cromwell and Fairfax, and Cromwell, in a series of masterly movements, subjugated Ireland and gained the important victories of Dunbar and Worcester. At sea Blake had destroyed the Royalist fleet under Rupert, and was engaged in an honourable struggle with the Dutch under van Tromp. But within the governing body matters had come to a deadlock. A dissolution was necessary, yet Parliament shrunk from dissolving itself, and in the meantime the reform of the law, a settlement with regard to the Church, and other important matters remained untouched. In April, 1653, Cromwell cut the knot by forcibly ejecting the members and putting the keys of the House in his pocket. From this time he was practically head of the Government, which was vested in a council of thirteen. A Parliament—the Little or Barebones Parliament—was summoned, and in the December of the same year Cromwell was installed Lord Protector of the Commonwealth of England, Scotland, and Ireland. With more than the power of a king, he succeeded in dominating the confusion at home, and made the country feared throughout the whole of Europe. Cromwell died in 1658, and the brief and feeble protectorate of his son Richard followed.

There was now a widespread feeling that the country would be better under the old form of government, and Charles II, son of Charles I, was called to the throne by the Restoration of 1660. He took complete advantage of the popular reaction from the narrowness and intolerance of Puritanism, and even endeavoured to carry it to the extreme of establishing the Catholic religion. The promises of religious freedom made

by him before the Restoration in the Declaration of Breda were broken by the Test and Corporation Acts, and by the Act of Uniformity, which drove two thousand clergymen from the Church and created the great dissenting movement of modern times. The Conventicle and Five-mile

James II (1685-8). An invasion by an illegitimate son of Charles, the Duke of Monmouth, who claimed the throne, was suppressed, and the king's arbitrary rule was supported by the wholesale butcheries of such instruments as Kirke and Jeffreys. The king's zealous coun-

tenance of Roman Catholicism and his attempts to force the Church and the universities to submission provoked a storm of opposition. Seven prelates were brought to trial for seditious libel, but were acquitted amidst general rejoicings. The whole nation was prepared to welcome any deliverance, and in 1688 William of Orange, husband of James's daughter Mary, landed in Torbay. James fled to France, and a convention summoned by William settled the crown upon him, he thus becoming William III. Annexed to this settlement was a Declaration of Rights circumscribing the royal prerogative by depriving him of the right to exercise dispensing power, or to exact money, or maintain an army without the assent of Parliament. This placed henceforward the right of the British sovereign to the throne upon a purely statutory basis. The Toleration Act, passed in 1689, released dissent from many penalties. An armed opposition to William lasted for a short time in Scotland, but ceased with the fall of Viscount Dundee, the leader of James's adherents; and though the struggle was prolonged in Ireland, it was brought to a close before the end of 1691. The following year saw the origination of the national debt, the exchequer having been drained by the heavy military expenditure. A Bill for triennial Parliaments was passed in 1694, the year in which Queen Mary died. For a moment after her death William's popularity

Acts followed, and the 'Drunken Parliament' restored Episcopacy in Scotland. At one time even civil war seemed again imminent. The abolition of the censorship of the press (1079) and the reaffirmation of the Habeas Corpus principle are the most praiseworthy incidents of the reign.

As Charles II left no legitimate issue, his brother the Duke of York succeeded him as

was in danger, but his successes at Namur and elsewhere, and the obvious exhaustion of France, once more confirmed his power. The Treaty of Ryswick followed in 1697, and the death of James II in exile in 1701 removed a not unimportant source of danger. Early in the following year William also died, and by the Act of Settlement Anne succeeded him.

The closing act of William's reign had been



the formation of the grand alliance between England, Holland, and the German Empire, and the new queen's rule opened with the brilliant successes of Marlborough at Blenheim (1704) and Ramillies (1706). Throughout the earlier part of her reign the Marlboroughs practically ruled the kingdom, the duke's wife, Sarah Jennings, being the queen's most intimate friend and adviser. In 1707 the history of England becomes the history of Britain, the Act of Union passed in that year binding the Parliaments and Realms of England and Scotland into a single and more powerful whole. See *Britain*.

*Ecclesiastical History.*—The first religion of the Celts of England was Druidism. It has been conjectured that Christianity may have reached Britain by way of France (Gaul) before the conclusion of the first, or not long after the commencement of the second century, but the period and manner of its introduction are uncertain. It had, however, made considerable progress in the island previous to the time of Constantine the Great (300-337). Several bishops from Britain sat in the Councils of Nice (325), Sardica (347), and Ariminum, in Italy (359); and in 519 an ecclesiastical synod of all the British clergy was held by St. David, Archbishop of Caerleon, for extirpating the remains of the Pelagian heresy.

A period of almost total eclipse followed the inroad of the pagan Saxons, and it was not till A.D. 570 that signs of change showed themselves in the new nationality. On the coming of Austin, or St. Augustine, sent over in 596 by Gregory the Great, a residence at Canterbury was assigned to him, and Ethelberht, King of Kent, and most of his subjects, adopted Christianity. Other missionaries followed; East Saxons were soon after converted by Mellitus; and a bishop's see was established at London, their capital, early in the seventh century. The Northumbrians were next converted, an event accelerated by the marriage of their king, Edwin, with a daughter of Ethelberht, and by the labours of the missionary Paulinus. The influence of Edwin and Paulinus also secured the conversion of Cædwalla, King of the East Angles; and, as a reward to Paulinus, Edwin erected a see at York, and obtained an archbishop's pall for him from Pope Honorius I, who sent one at the same time to Canterbury. The conversion of the other kingdoms followed in the course of the seventh century.

As Kent and Wessex received Christianity from Roman and Frankish missionaries, and Mercia and Northumberland through the Scottish St. Aidan (for Northumbria had apostatized after the death of its first Christian king, and received Christianity anew from a Scottish source), there were certain differences between

the Churches, especially concerning the time of keeping Easter. To promote the union of the Churches thus founded in England with the Church of Rome, a grand council was summoned by Theodore of Tarsus, Archbishop of Canterbury, at Hertford, A.D. 673, when uniformity was secured among all the English Churches, and the see of Canterbury made supreme.

The clergy in course of time attained, particularly after the Norman Conquest, to such a height of domination as to form an *imperium in imperio*. Under Anselm (1093-1109) the Church was practically emancipated from the control of the State, and the power of the Pope became supreme. The result was a considerable increase of monasticism in England, and the prevalence of the greatest abuses under the cloak of Church privilege. Several monarchs showed themselves restive under the Papal control, but without shaking off the yoke; and though Henry II succeeded in abating some evils, yet the severity of the penance exacted from him for the murder of Becket is a striking proof of the power that the Church then had in punishing offences committed against itself. The reaction set in during the reign of Henry III, when the vigorous independence of Robert Grosseteste did much to stimulate the individual life of the English Church. With the reign of Edward I the new system of Parliaments came as an effective rival of the Church Synods, and various Acts restrained the power of the clergy. In the fourteenth century the teaching of Wycliffe promised to produce a thorough revolt from Rome; but the difficulties of the House of Lancaster—which drove its members to propitiate the Church—and the Wars of the Roses, prevented matters coming to a head.

A steady decay of vital power set in, however, and when Henry VIII resolved to recast the English Church there was no effective protest. In 1531 the convocation of the clergy addressed a petition to Henry VIII as the chief protector and only and supreme lord of the English Church. Not very long after, the Parliament abolished appeals to the see of Rome, dispensations, licences, bulls of institution for bishoprics and archbishoprics, the payment of Peter's-pence, and the annates. In 1534 the Papal authority was set aside by Act of Parliament, and by another Act of Parliament, passed in 1535, Henry assumed the title of supreme head of the Church of England. These Acts, although they severed the connection between the English Church and the Holy See, did not alter the religious faith of the Church. But under Edward VI the Duke of Somerset, the protector of the realm during the minority of the king, caused a more thorough reform of the doctrines and ceremonies of the Church to be made. At

his instigation Parliament in 1547 repealed the statute of the six articles promulgated by Henry VIII, and in 1551 a new confession of faith was embodied in forty-two articles, denying the infallibility of councils, keeping only two sacraments, baptism and the Lord's Supper, and rejecting the real presence, the invocation of saints, prayer for the dead, purgatory, and the celibacy of the clergy. At the same time a new liturgy was composed, in which English was substituted for Latin.

With the reign of Mary the old religion was

From James I some relief was anticipated by Puritans and Nonconformists, but they were disappointed. Under Charles I the attempt was made, through the instrumentality of Laud, to place all the Churches of Great Britain under the jurisdiction of bishops. But after the death of Laud the Parliament abolished the episcopal government, and condemned everything contrary to the doctrine, worship, and discipline of the Church of Geneva. As soon as Charles II was restored, the ancient forms of ecclesiastical government and public worship were re-established, and three severe



Consecration of a Saxon Church

From an ancient manuscript of Cædmon's

re-established; and it was not till that of Elizabeth that the Church of England was finally instituted in its present form. The doctrines of the Church were again modified, and the Forty-two Articles were reduced to thirty-nine by the convocation of the clergy in 1563. As no change was made in the episcopal form of government, and some rites and ceremonies were retained which many of the reformed considered as superstitious, this circumstance gave rise to many future dissensions. In 1550, before the close of the first year of Elizabeth's reign, the Acts of Supremacy and Uniformity were passed with the object of bringing about the entire subjection of the Church and the people in religious matters to the royal authority.

measures were passed against nonconformity, namely, the Corporation Act of 1601, the Act of Uniformity, passed in 1662, and the Test Act, passed in 1673 (see *Act of Uniformity; Corporation and Test Acts*). In the reign of William III, and particularly in 1689, the divisions among the friends of Episcopacy gave rise to the two parties called the *high-churchmen* or *non-jurors*, and *low-churchmen*. The former maintained the doctrine of passive obedience to the sovereign; that the hereditary succession to the throne is of divine institution; and that the Church is subject to the jurisdiction of God alone. The gradual progress of civil and religious liberty since that time has settled practically all such controversies. The measures of

relief granted to those outside the Established Church include the repeal of the Corporation and Test Acts (1828), Catholic emancipation (1829), and the opening of the old universities to Dissenters (1871).

The Established Church of England has always adhered to Episcopacy. Under the sovereign as supreme head, the Church is governed by three archbishops and forty bishops, of Canterbury, York, and Wales. The Archbishop of Canterbury is styled the *Primate of all England*, and to him belongs the privilege of crowning the kings and queens of England. The province of Canterbury comprehends 30 bishoprics; in the province of the Archbishop of York, who is styled *Primate of England*, there are 12 bishoprics,

the province comprising Cheshire, Lancashire, Yorkshire, and the other northern counties. Wales has now been formed into a separate archbishopric. An Act was passed in 1914 disestablishing and disendowing the Church in Wales and Monmouthshire. The Act, suspended during the European War, came into force on 31st March, 1920. Archbishops and bishops are appointed by the sovereign by what is called a *congé d'élire*, or leave to elect, naming the person to be chosen and sent to the Dean and Chapter. The National Assembly of the Church of England (Powers) Act of 1919 instituted a National Assembly in England consisting of the House of Bishops, a House of Clergy, and a House of Laymen, which has power to legislate in Church matters. The archbishops and bishops, to the number of 24, have seats in the House of Lords, and are styled Lords Spiritual. The following are the bishops' sees: London, Winchester, Bangor, Bath and Wells, Birmingham, Bradford, Bristol, Chelmsford, Chichester, Coventry, Ely, Exeter, Gloucester, Hereford, Ipswich, Lichfield, Lincoln, Llandaff, Norwich, Oxford, Peterborough, Rochester, St. Albans, St. Asaph, St. David's, Salisbury, Southwark, Southwell, Truro, Worcester, Durham, Carlisle, Chester, Liverpool, Manchester, Newcastle, Ripon, Sheffield, Wakefield, Sodor and Man. To every cathedral belong several prebendaries and a dean; these together, spoken of as 'the Dean and Chapter', form the council of the bishop. The bishops are aided in their work by 86 suffragan and assistant bishops in England and Wales. The ordinary clergy are the *priests*, whether curates, vicars, or rectors. A *parson* is a priest in full possession of all the rights of a parish church; if the great tithes are *impropriated*, the priest is called a *vicar*; if not, a *rector*; a *curate* (in popular speech) is one who exercises the spiritual office under a rector or vicar. The *deacons* form the third order of ordained clergy. The doctrines of the Church are contained in the Thirty-nine Articles; the form of worship is directed by the *Book of Common Prayer*. The revenue of the Church from endowments is over £6,000,000 annually. The clergy number about 27,000. — BIBLIOGRAPHY: Wakeham, *Introduction to the History of the Church of England*; Newbolt and Stone, *Church of England*.

*English Art.*—As regards *architecture* little can be said with regard to the style prevalent between the invasion of the Anglo-Saxons and the Norman Conquest, from the fact that the remains of buildings erected in England before the Conquest are few and insignificant. The Norman style was introduced in the reign of Edward the Confessor, though the workmen, both then and after the Conquest, being English, the earlier work preserved many native characteristics. The

Norman period proper extends from about 1080 to 1150, some of the best examples being parts of the cathedrals of Rochester, Winchester, Durham, and Canterbury. In the brief period 1160 to 1195 a marked change took place in the adoption of the pointed arch and what is known as the *Early English style*. Improved methods of construction led to the use of lighter walls and pillars instead of the heavy masses employed in the Norman style. Narrow lancet-shaped windows took the place of the round arch; bold projecting buttresses were introduced; and the roofs and spires became more lofty and more pointed, while in the interiors pointed arches rested on lofty clustered pillars. The best Early English type is Salisbury Cathedral. The Early English style has been regarded as lasting from 1190 to 1270, when the *Decorated style* of Gothic began to prevail. The transition to the Decorated style was gradual, but it may be considered as lasting to 1377. Exeter Cathedral is an excellent example of the earliest Decorated style. Between 1300 and 1399 the Decorated style gave place to the *Perpendicular*, which prevailed from 1377 to 1547, and was an exclusively English style. Gothic architecture, though it lingered on in many districts, practically came to an end in England in the reign of Henry VIII. The *Elizabethan* and *Jacobean styles*, which followed, were transitions from the Gothic to the Italian, with which these styles were more or less freely mixed. Many palatial mansions were built in these styles. In the reign of Charles I Inigo Jones designed, among other buildings, Whitehall Palace and Greenwich Hospital in a purely classic style. After the great fire in London (1666) Sir Christopher Wren designed an immense number of churches and other buildings in Classic style, particularly St. Paul's Cathedral, the Sheldonian Theatre of Oxford, and Chelsea Hospital. Various phases of Classic or Renaissance continued to prevail during the eighteenth and earlier part of the nineteenth century. About 1836 the Gothic revival commenced, and that style has been employed with considerable success in the churches erected in recent times. The Houses of Parliament, erected between 1840 and 1860 in the Tudor style, the Law Courts of Salford, St. Pancras railway station, and the Law Courts of London (opened 1882) in the Gothic served to sustain an impetus that had been given to the use of that style. At the present day Gothic is much employed for ecclesiastical and collegiate buildings, and a modified type of Renaissance for civil buildings. Of late years a style that has received the name of 'Queen Anne' is much in vogue for private residences. It is very mixed, but withal highly picturesque. The most striking novelties in the nineteenth century have been induced by the

extensive use of iron and glass, as exemplified in the Exhibition building of 1851, the Crystal Palace, Sydenham, and the great railway stations.

Very little is known of the state of the art of painting among the Anglo-Saxons; but in the ninth century Alfred the Great caused numerous MSS. to be adorned with miniatures, and about the end of the tenth century Archbishop Dunstan won reputation as a miniature painter. Under William the Conqueror and his two sons the painting of large pictures began to be studied, and Lanfranc, Archbishop of Canterbury, adorned the vault of his church with paintings. Numerous miniatures of the thirteenth and fourteenth centuries have come down to us, rude in execution, but not without originality. From this period down to the eighteenth century a succession of foreign painters resided in England, of whom the chief were Mabuse, Hans Holbein, Federigo Zuccheri, Cornelius Jansen, Van Dyck, Lely, and Kneller. Of native artists few are of importance prior to that original genius William Hogarth (1697-1764). Throughout the eighteenth century English artists attained higher eminence in portrait painting than in other departments, and it culminated in Sir Joshua Reynolds (1723-92), Thomas Gainsborough (1727-88), and Romney (1734-1802). These were followed by Raeburn (1756-1823) and Lawrence (1769-1830). Barry (1741-1806), West (1738-1820), and Copley (1737-1815) gained distinction in historical compositions, especially in pictures of battles. Landscape painting was represented by Richard Wilson (1714-82), who painted classical scenes with figures from heathen mythology, and by Gainsborough, already mentioned, who painted scenes of English nature and humble life. The Royal Academy of Arts, of which Reynolds was the first president, was established in London in 1769. Sir David Wilkie (1785-1841), in what is known abroad as genre painting, gained a European reputation that is unsurpassed. In the same class of art C. H. Leslie (1794-1859), Newton (1795-1835), Collins (1788-1847), and Mulready (1786-1863) gained great distinction. In landscape the reputation of Turner (1775-1857) stands alone. Other distinguished landscape painters are Clarkson Stanfield (1798-1807); David Roberts (1796-1864), who greatly excelled in picturesque architecture; Wm. Müller (1812-45); and John Constable (1776-1837), whose works exercised great influence in France; and Calcott (1799-1844). In historical painting Hilton (1786-1839), Eastlake (1799-1865), Etty (1787-1849), E. M. Ward (1816-79), C. W. Cope (1811-90), and D. Maclise (1811-70) attained celebrity. John Philip (1817-67) greatly distinguished himself by his scenes from Spanish life and by his mastery in colour. Landseer (1803-73) stands by himself as a painter of animals.

In 1824 the nucleus of the National Gallery was formed by the purchase of the Angerstein collection, and in 1832 the vote was passed for the erection of the National Gallery building. The competitions held in Westminster Hall in 1843, 1844, and 1847, with a view to the decoration of the Houses of Parliament, exercised great influence on art. Up to this time English pictures were rather distinguished for colour and effect of light and shade than for carefulness of modelling and exactness of drawing. In order to bring about a more accurate and careful style of work, the Pre-Raphaelites (1840-60), while seeking to restore in their practice an early phase of Italian art, exercised a beneficial influence, while they themselves ultimately abandoned the style to which at the first they had been devoted.

The modern group of British painters may be held to date from about 1850. Prominent among these the following may be named: In historical painting Leighton, Alma-Tadema, Watts, Poynter, Long, Goodall, Holman Hunt, Noel Paton, Burne-Jones, and Madox Brown, as also W. P. Frith, whose *Derby Day* and *Railway Station*, so descriptive of modern life, may well be classed as historical. In figure painting or genre T. Faed, Friskine Nicol, Fildes, Orchardson, Herkomer, Millais, and Pettie. In portraiture Millais, Frank Holl, Oulless, and Richmond. In landscape Linnell, Hook, W. J. Müller, Peter Graham, John Brett, Vicat Cole, H. Moore, Keeley Halswelle. In water-colours the most eminent artists have been Girtin (1773-1802), Colman (1782-1842), Liverseege (1803-32), Stothard (1755-1834), Turner, David Cox (1788-1859), De Wint (1784-1849), Copley Fielding (1787-1855), Samuel Prout (1783-1852), W. H. Hunt (1790-1864), Louis Haghe (1806-85), W. L. Leitch (1804-83), Sam Bough (1822-78), John Gilbert (1817-97). —BIBLIOGRAPHY: R. Muther, *History of Modern Painting*; S. Reinach, *Apollo*.

English sculpture was long merely an accessory to architecture, and few English sculptors are known by name till comparatively modern times. During the Renaissance period Torregiano came from Italy and executed two masterpieces in England, the tomb of the mother of Henry VII, and that of Henry himself at Westminster. The troubles of the reign of Charles I and the Commonwealth produced a stagnation in the art, and were the cause of the destruction of many valuable works. After the Restoration two sculptors of some note appeared, Grinling Gibbons, a wood-carver, and Caius Gabriel Cibber. During the eighteenth century there was no English sculptor of great eminence till John Flaxman (1755-1826). He had for rival and successor Sir Francis Chantrey (1781-1841), who acquired renown by the busts and statues which

he made of many of the eminent men of his time. John Carew, Sir Richard Westmacott (1775-1856), E. H. Baily (1789-1867), John Gibson (1790-1866), P. MacDowell (1799-1870), H. Weekes (1807-77), J. H. Foley (1818-74), J. Edgar Boehm (1834-90), and Thomas Woolner (1825-92) are a few of the eminent sculptors of the nineteenth century. W. H. Thorneycroft, E. Onslow Ford, C. B. Birch, Alfred Gilbert, G. F. Watts, Henry H. Armstead, G. Simons, Sir Thomas Brock, Harry Bates, and Sir George Frampton are among the foremost sculptors of the present time. The sculptures of the English school in general are characterized by a sort of romantic grace which is their distinguishing mark, and by extraordinary delicacy and finish in detail; but they frequently exhibit weakness in their treatment of the nude.—BIBLIOGRAPHY: Wilhelm Lübke, *History of Sculpture*; E. H. Short, *History of Sculpture*.

*English Language*.—The language spoken in England from the settlement of the Anglo-Saxons to the Norman Conquest (say 500-1066) is popularly known as Anglo-Saxon, though simply the earliest form of English. (See *Anglo-Saxons*.) It was a highly inflected and purely Teutonic tongue presenting several dialects. The Conquest introduced the Norman-French, and from 1066 to about 1250 two languages were spoken, the native English speaking their own language, the intruders speaking French. During this period the grammatical structure of the native language was greatly broken up, inflexions fell away, or were assimilated to each other; and towards the end of the period we find a few words written in a language resembling the English of our own day in grammar, but differing from it by being purely Saxon or Teutonic in vocabulary. Finally, the two languages began to mingle, and form one intelligible to the whole population, Normans as well as English, this change being marked by a great infusion of Norman-French words, and English proper being the result. English is thus, in its vocabulary, a composite language, deriving part of its stock of words from a Teutonic source and part from a Latin source, Norman-French being in the main merely a modified form of Latin. In its grammatical structure and general character, however, English is entirely Teutonic, and is classed with Dutch and Gothic among the Low German tongues. If we divide the history of the English language into periods, we shall find three most distinctly marked: first, the Old English or Anglo-Saxon, extending down to about 1100; second, the Middle English, 1100-1400 (to this period belong Chaucer, Wycliffe, Langland); third, Modern English. A more detailed subdivision would give transition periods connecting the main ones. The chief change

which the language has experienced during the modern period consists in its absorbing new words from all quarters in obedience to the requirements of advancing science, more complicated social relations, and increased subtlety of thought. At the present time the rapid growth of the sciences already existing, and the creation of new ones, have caused whole groups of words to be introduced, chiefly from the Greek, though unfortunately not a few are hybrid words, coined by some scientist who had small Latin and less Greek.—Cf. H. Sweet, *New English Grammar, Logical and Historical*.

*English Literature*.—Before any English literature, in the strict sense of the term, existed, four literatures had arisen in England—the Celtic, Latin, Anglo-Saxon, and Anglo-Norman. The first includes such names as those of Taliesin, Llywarch Hen, Aneurin, and Merlin or Merddin. The Latin literature prior to the Conquest presents those of Aldhelm, Bede, Alcuin, Asser, Rihelwerd, and Nemius. For Anglo-Saxon literature, see the article *Anglo-Saxons*. With the coming of the Normans, although the *Anglo-Saxon Chronicle* was continued until 1154, the native language practically ceased for a time to be employed in literature, Latin being used in law, history, and philosophy, French in the lighter forms of literature. The Norman *trouvère* displaced the Saxon *scop*, or gleeman, introducing the *Fabliau* and the Romance. By the *Fabliau* the literature was not greatly influenced until the time of Chaucer; but the Romance attained an early and striking development in the Arthurian cycle, founded upon the legends of Geoffrey of Monmouth's *Latin History of the Britons* (1147), by Geoffrey Gaimar, Wace, Walter Map, and other writers of the twelfth century. The Latin literature included important contributions to the Scholastic philosophy by Alexander Hales (died 1245), Duns Scotus (died 1308) and William of Occam (died 1347); the philosophic works of Roger Bacon (1214-92); the *Goliath* poems of Walter Map; and a long list of chronicles or histories, either in prose or verse, by Radmer (died 1124); Ordericus Vitalis (died 1142), William of Malmesbury (died 1143), Geoffrey of Monmouth (died 1154), Henry of Huntingdon (died after 1154), Joseph of Exeter (died 1195), Gervase of Tilbury (twelfth century), Roger of Wendover (died 1237), Roger de Hoveden (twelfth and thirteenth centuries), Giraldus Cambrensis (died 1222), Jocelin de Brakelonde (twelfth and thirteenth centuries), and Matthew Paris (died 1259).

Apart from a few brief fragments, the first English writings after the Conquest are the *Brut* of Layamon (about 1200), based on the *Brut* of Wace; and the *Ormulum*, a collection of metrical homilies attributed to Orm or Ormin, an August-



tine monk. Next in importance come the rhyming chroniclers Robert of Gloucester (time of Henry III, Edward I) and Robert of Brunne or Mannyng (died 1340), other writers being Dan Michel of Northgate (*Ayenbile of Inwyrt*, 1340); Richard Rolle of Hamphole (*Pricke of Conscience*, 1340); Laurence Minot (author of eleven military ballads; died 1352); and several works of uncertain authorship, including the *Ancien Riwle* (? Richard Poor, died 1287), *The Owl and the Nightingale* (? Nicholas of Guildford), *The Land of Cockayne* (? Michael of Kildare), the song against the King of Almaine, and a dialogue between the Body and the Soul. To this pre-Chaucerian period belong also several English translations of French romances—*Horn*, *Tristrem*, *Alisaunder*, *Iiaveluk*, and others. Between the beginning and middle of the fourteenth century the English speech had entered upon a new phase of development in the absorption of Norman-French words. A rapid expansion of the literature followed, having as the foremost figure that of Chaucer (1340-1400), who, writing at first under French influences, and then under Italian; became in the end the most representative English writer of the time. Contemporary with him was the satirist William Langland or Langley (1332-1400), the indefatigable John Gower (1325-1408), and the Scot John Barbour (1316-95). In prose the name of John Wycliffe (1324-84) is pre-eminent, the English version of Mandeville's *Travels* being apparently of later date.

The period from the time of Chaucer to the appearance of Spenser, that is, from the end of the fourteenth to near the end of the sixteenth century, is a very barren one in English literature, in part probably owing to foreign and domestic wars, the struggle of the people towards political power, and the religious controversies preceding and attending the Reformation. The immediate successors of Chaucer, Occleve (1370-1454) and Lygiate (died 1460), were neither men of genius, and the centre of poetic creation was for the time transferred to Scotland, where James I (1394-1437) headed the list which comprises Andrew de Wyntoun (fifteenth century), Henry the Minstrel or Blind Harry (died after 1492), Robert Henryson (died before 1508), William Dunbar (1460-1520), Gavin Douglas (1474-1522), and Sir David Lyndsay (1490-1557). In England the literature was chiefly polemical, the only noteworthy prose prior to that of More being that of Reginald Pecock (1390-1460); Sir John Fortescue (1395-1485); the *Paston Letters* (1422-1505), which are, however, much more interesting for their subject matter than their style; and Malory's *Morte d'Arthur* (completed 1469-70); the only noteworthy verse, that of John Skelton (1460-1529).

It was now that several events of European

importance combined to stimulate life and enlarge the mental horizon—the invention of printing, or rather of movable types, the promulgation of the Copernican system of astronomy, the discovery of America, the Renaissance, and the Reformation. The Renaissance spread from Florence to England by means of such men as Colet, Linacre, Erasmus, and Sir Thomas More (1480-1535), the last noteworthy as at the head of a new race of historians. Important contributions to the prose of the time were the Tyndale *New Testament*, printed in 1525, and the Coverdale *Bible* (1535). The first signs of an artistic advance in poetic literature are to be found in Wyatt (1503-42) and Surrey (1516-47), who nationalized the sonnet; Surrey was also a pioneer in the use of blank verse. The drama, too, had by this time reached a fairly high stage of development. The mystery and miracle plays, after the adoption of the vernacular in the fourteenth century, passed from the hands of the clergy into those of the laity, and both stage and drama underwent a rapid secularization. The morality began to embody matters of religious and political controversy, historical characters mingled with the personification of abstract qualities, real characters from contemporary life were introduced, and at length farces on the French model were constructed, the *Interludes* of John Heywood (died 1565) being the most important examples. To Nicholas Udall (1504-56) the first genuine comedy, *Ralph Roister Doister*, was due, this being shortly afterwards followed by John Still's *Gammer Gurton's Needle* (1566). The first tragedy, the *Ferrex and Porrex*, or *Gorboduc* of Sackville (died 1608) and Norton (died 1600), was performed in 1561, and the first prose play, the *Supposes* of Gascoigne (died 1577) in 1566. Gascoigne and Sackville were noteworthy amongst the earlier Elizabethans apart from their plays; but the figures which bulk most largely are those of Sidney (1554-86) and Spenser (1552-99). In drama Lyly, Peele, Greene, Nash, and Marlowe (1564-93) are the chief immediate precursors of Shakespeare (1564-1616), Marlowe alone, however, being at all comparable with the great master. Contemporary and later dramatic writers were Ben Jonson (1573-1637), the second great Elizabethan dramatist, Middleton (died 1627), Marston (better known as a satirist), Chapman (1557-1634), Thomas Heywood, Dekker (died 1639), Webster (seventeenth century), Ford (1586-1639), Beaumont (1586-1616) and Fletcher (1570-1625), and Massinger (1584-1640). The minor poets include Michael Drayton (1568-1631), Samuel Daniel (1562-1619), John Davies (1570-1626), John Donne (1573-1631), Giles Fletcher (1580-1623), and Phineas Fletcher (1584-1633), Drummond of Hawthornden (1585-1640). In Elizabethan

prose the prominent names are those of Roger Ascham (1515-88), John Lyly (1553-1606), Hooker (1554-1600), Raleigh (1552-1618), Bacon (1561-1626), the founder in some regards of modern scientific method, Burton (1576-1640), Herbert of Cherbury (1581-1633), and Selden (1584-1654), with Overbury, Knolles, Holinshed, Stowe, Camden, Florio, and North. The issue of the Authorized Version of the Bible in 1611 may be said to close the prose list of the period, as it represents the finest flower of English prose.

After the death of James I the course of literature breaks up into three stages, the first from 1625 to 1640, in which the survivals from the Elizabethan Age slowly die away. The 'metaphysical poets', Cowley, Wither, Herbert, Crashaw, Habbington, and Quarles, and the cavalier poets, Suckling, Carew, Denham, all published poems before the close of this period, in which also Milton's early poems were composed, and the *Comus* and *Lycidas* published. The second stage (1640-60) was almost wholly given up to controversial prose, the Puritan revolution checking the production of pure literature. In this controversial prose of the time Milton was easily chief. With the Restoration a third stage was begun. Milton turned his new leisure to the composition of his great poems; the drama was revived, and Davenant and Dryden, with Otway, Southerne, Etherege, Wycherley, Congreve, Vanbrugh, and Farquhar in their first plays, and minor playwrights, are the most representative writers of the period. Butler established a genre in satire, and Marvell as a satirist in some respects anticipated Swift; Roscommon, Rochester, and Dorset contributed to the little poetry; while in prose we have Hobbes, Clarendon, Fuller, Sir Thomas Browne, Walton, Cotton, Pepys and Evelyn, John Bunyan, Locke, Sir William Temple, Owen Feltham, Sir Henry Wotton, James Harrington, and a crowd of theological writers, of whom the best known are Jeremy Taylor, Richard Baxter, Robert Barclay, William Penn, George Fox, Isaac Barrow, John Tillotson, Stillingfleet, Bishop Pearson, Sherlock, South, Sprat, Cudworth, and Burnet. Other features of the last part of the seventeenth century were the immense advance in physical science under Boyle, Isaac Newton, Harvey, and others, and the rise of the newspaper press.

Dryden's death in 1700 marks the commencement of the so-called Augustan Age in English literature. During it, however, no greater poet appeared than Pope (1688-1744), in whom sagacity, wit, and fancy take the place of the highest poetic faculty, but who was a supreme artist within the formal limits of his conception of the art of poetry. Against these formal limits signs of reaction are apparent in the verse of Thomson (1700-48), Gray (1716-71), Collins (1720-59),

Goldsmith (1728-74), and in the productions of Macpherson and Chatterton. The poets Prior (1664-1721), Gay (1688-1732), and Ambrose Phillips (1671-1749) inherit from the later seventeenth century, Gay being memorable in connection with English opera; and there are many minor poets—Garth, John Phillips, Blackmore, Parnell, Dyer, Somerville, Green, Shenstone, Blair, Akenside, Falconer, Anstey, Beattie, Allan Ramsay, and Robert Ferguson. It is in prose that the chief development of the eighteenth century is to be found. Defoe (1661-1731) and Swift (1667-1745) led the way in fiction and prose satire; Steele (1672-1729) and Addison (1672-1719), working on a suggestion of Defoe, established the periodical essay; Richardson (1689-1761), Fielding (1707-54), Smollett (1721-71), and Sterne raised the novel to sudden perfection. Goldsmith also falls into the fictional group as well as into that of the poets and of the essayists. Johnson (1709-84) exercised during the latter part of his life the power of a literary dictator, with Boswell (1740-95) as his 'Secretary of State'. The other chief prose writers were Bishop Berkeley (1685-1753), Arbuthnot (1675-1735), Shaftesbury (1671-1713), Bolingbroke (1678-1751), Burke, the historians David Hume (1711-76), William Robertson (1721-98), Edward Gibbon (1737-94); the political writers Wilkes and 'Junius', the economist and moral philosopher Adam Smith (1723-90); the philosophical writers Hume, Bentham (1748-1832), and Dugald Stewart (1753-1828); the scholars Bentley (1662-1742), Sir William Jones (1746-94), and Richard Porson (1759-1808); the theologians Atterbury, Butler (1692-1752), Warburton, and Paley; and some playwrights, of whom the most important was Sheridan, but who also included Rowe, John Home, Colley Cibber, Colman the elder, and Foote.

With the French Revolution, or a few years earlier, the modern movement in literature may be said to have commenced. The departure from the old traditions, traceable in Gray and Collins, was more clearly exhibited in the last years of the century in Cowper (1731-1800) and Burns (1759-96), and was developed and perfected in the hands of Blake (1757-1828), Bowles (1762-1850), and the 'Lake poets' Wordsworth (1770-1850), Coleridge (1772-1834), and Southey (1774-1843); but there were at first many survivals from the poetic manner of the seventeenth century, such as Erasmus Darwin (1731-1802), Dr. John Wolcot (1738-1819), and Samuel Rogers (1768-1855). Amongst the earlier poets of the nineteenth century, also, were George Crabbe (1754-1832), Sir Walter Scott (1771-1832), Hogg (1772-1835), Campbell (1777-1844), James Montgomery, Mrs. Hemans, Bryan Waller Procter ('Harry Cornwall'), Joanna Baillie, Robert

Montgomery. A more important group was that of Byron (1788-1824), Shelley (1792-1822), and Keats (1796-1821), with which may be associated the names of Leigh Hunt (1784-1859), Thomas Moore (1779-1852), and Landor (1775-1864). Among the earlier writers of fiction there were several women of note, such as Maria Edgeworth (1767-1840) and Jane Austen (1775-1817). The greatest name in fiction is unquestionably that of Scott. Other prose writers were Malthus, Hume, James Mill, Southey, Hannah More, Cobbett, William Hazlitt, Sydney Smith, Francis Jeffrey, Lord Brougham. In the literature since 1830 poetry has included as its chief names those of Prue, Hood, Sidney Dobell, Gerald Massey, Charles Mackay, Philip James Bailey, William Allingham, Elizabeth Barrett Browning, Coventry Patmore, the second Lord Lytton ('Owen Meredith'), Arthur Hugh Clough, Matthew Arnold, Dante G. Rossetti, Robert Buchanan, Wm. Morris, Lewis Morris, Jean Ingelow, Swinburne, and last and greatest, Tennyson and Browning. Among more modern English poets are Stephen Phillips (1868-1915), Francis Thompson (1860-1907), Sir William Watson (born 1858), John Davidson (1857-1909), and R. Kipling (born 1865). A brilliant list of nineteenth-century novelists includes Marryat, Michael Scott, the first Lord Lytton, Ainsworth, Benjamin Disraeli (Earl of Beaconsfield), Dickens, Thackeray, Charles Kingsley, Charlotte Brontë, Lover, Lever, Wilkie Collins, Mayne Reid, Charles Reade, George Eliot, Anthony Trollope, William Black, Thomas Hardy, R. D. Blackmore, George Meredith, R. L. Stevenson, Miss Bradton, Mrs. Craik (Miss Mulock), Mrs. Oliphant, Miss Yonge, and others. Towards the end of the nineteenth and at the beginning of the twentieth century there was a deepening interest in the drama, and the list of brilliant dramatists includes the names of Barric, H. A. Jones, G. B. Shaw, Pinero, Granville Barker, and others. The tendency in the fiction of the twentieth century is a concrete and imaginative presentation of the social, ethical, and sentimental problems of the day. This tendency is clearly seen in the novels of John Galsworthy and H. G. Wells. To the historical and biographical list of the nineteenth century belong Macaulay, Buckle, Carlyle, Thirlwall, Grote, Milman, Froude, Lecky, S. R. Gardiner, Kinglake, John Richard Green, E. A. Freeman, Stubbs, Dean Stanley, John Morley, Leslie Stephen. In science and philosophy among the chief writers of the nineteenth century have been Whewell, Sir W. Hamilton, Mansel, John Stuart Mill, Alexander Bain, Hugh Miller, Charles Darwin, Huxley, Tyndall, Max Müller, Herbert Spencer, T. H. Green.—**BIBLIOGRAPHY:** *Cambridge History of English Literature*; Taine, *History of English Literature*; Saintsbury, *Short*

*History of English Literature*; Chambers, *Cyclopedia of English Literature*.

**English Architecture, Art, Church, Language, Literature, &c.** See *England*.

**English Channel** (Fr. *La Manche*, the sleeve), the arm of the sea which separates England from France, extending, on the English side, from Dover to Land's End; and on the French, from Calais to the Island of Ushant. On the east it communicates with the North Sea by the Straits of Dover, 21 miles wide; and on the west it opens into the Atlantic by an entrance about 100 miles wide. At its greatest breadth it is about 150 miles. The pilchard and mackerel fisheries are very important. The advantages of a railway tunnel under the Channel at or near its narrowest part have been frequently urged; and an English company, formed in 1887 for constructing a tunnel from Dover, to meet a similar tunnel starting from near Calais, has pushed an excavation under the sea for over 2000 yards. The plan, opposed by the British Government for military reasons in 1907, has now been approved of. Plans have also been put forward for a railway bridge across the Straits of Dover.

**Engraving**, the art of drawing or writing on metal, wood, precious stones, &c., by means of incisions made with instruments variously adapted to the substances operated upon and the description of work intended. The term is also applied to the work so performed, and to impressions taken on paper or similar material from the engraved work. Impressions from metal plates are called engravings, prints, or plates; those printed from wood being termed indifferently wood engravings or wood-cuts. While, however, these impressions are not altogether dissimilar in appearance, the processes are distinct. As a rule, in prints from metal the lines intended to print are incised, and in order to take an impression the plate is dabbed over with a thick ink which fills all the lines. The surface is then wiped perfectly clean, leaving only the incised lines filled with ink. A piece of damp paper is then laid on the face of the plate, and both are passed through the press, which causes the ink to pass from the plate to the paper. This operation needs to be repeated for every impression. In the wood block, on the contrary, the spaces between the lines of the drawing are cut out, leaving the lines standing up like type, the printing being from the inked surface of the raised lines, and effected much more rapidly than plate printing. This process has also been used to a certain extent with metal.

Engraving on wood, intended for printing or impressing from, long preceded engraving on metals. The art is of Eastern origin, and at least as early as the tenth century engraving and

printing from wood blocks was common in China. We first hear of wood engraving being cultivated in Europe by the Italians and Germans for impressing patterns on textiles, but no paper impressions earlier than the fourteenth century are known. For a hundred years there is small indication of the practice of the art, which was at first confined to the production of block-books, playing-cards, and religious prints. According to Vasari, the art of printing from engraved plates was discovered in Florence by Maso Finiguerra about 1400, but engravings of earlier date are known to exist. Engraving had long been used as a means of decorating armour, metal vessels, &c., the engravers generally securing duplicates of their works before laying in the niello (a species of metallic enamel) by taking casts of them in sulphur, and rubbing the lines with black. The discovery of the practicability of taking impressions upon paper helped the development of engraving upon copper plates for the purpose of printing from. The date of the earliest known niello proof upon paper is 1452. The work of the Florentine engravers,<sup>1</sup> however, was almost at once surpassed in Venice and elsewhere in North Italy by Andrea Mantegna (1431-1506), Girolamo Mocetto, Jacopo de' Barbari, and others. In Marc Antonio Rainondi (1475-1534), who wrought under the guidance of Raphael, and reproduced many of his works, the art reached its highest point of the earlier period, and Rome became the centre of a new school, which included Marco da Ravenna (died 1527), Giulio Bonasone (1531-72), and Agostino de Musis (flourished 1536). In the meantime, in Germany the progress of the art had been not less rapid. Of the oldest school the most important engraver is Martin Schongauer (1420-88). He was, however, surpassed a generation later by Albert Dürer (1471-1528), who excelled both in copper and wood engraving, especially in the latter, and also etched a few plates. Among his most famous contemporaries and successors were Burgkmair and Lucas Cranach. The Dutch and Flemish schools, of which Dürer's contemporary Lucas van Leyden was the head, did much to enlarge the scope of the art, either by paying increased attention to the rendering of light and shade, and the expression of tone and surface quality, as in the case of Cornelius Cort and Bloemart; or by developing freedom and expression of line, as in the case of Goltzius and his pupils. Rubens (1577-1640) influenced engraving through the two Bolswerts, Vorstermann, Pontius, and P. de Jode, who engraved many of his works on a large size. Towards the end of the seventeenth century etching, which had before been rarely used, became more common, and was practised with supreme mastery by

Rembrandt (1607-69) and other painters of that period. In France, Noel Garnier founded a school of engraving about the middle of the sixteenth century; but it produced no work of any high distinction until the reign of Louis XIV, when Robert Nanteuil, his follower Gerard Edelineck, and Antoine Masson produced many fine portraits, and Gerard Audran engraved works by Nicolas Poussin and Le Brun. Jacques Callot also produced some admirable etchings. These were followed about the middle of the eighteenth century by Wille (1717-1807), a German resident in Paris, who gave new vitality to a waning art, and by the school of French illustrators. Before the middle of the seventeenth century England produced little noteworthy work, availing herself principally of the work of foreign engravers such as Wenzel Hollar, of whom many took up temporary and even permanent residence. The first English engraver of marked importance was William Hogarth (1697-1764), whose works are distinguished for a power of vivid characterization. Vivares (1712-82), a Frenchman by birth, laid the foundation of the English school of landscape engraving, which was still further developed by William Woollet (1735-85), who was also an excellent engraver of the human figure. In historical engraving a not less remarkable advance was made by Sir Robert Strange (1721-92); and Richard Earlom (1743-1822), Valentine Green, and J. R. Smith produced some admirable works in mezzotint. In succession to these came William Sharp (1740-1824), James Baire (1730-1802), Bartolozzi (1727-1815), who practised stipple engraving, James Heath, Bromley, Raimburch, and others. The substitution of steel for copper plates (1820-30) gave the power of producing a much larger number of fine impressions, and opened new possibilities for highly finished work. During the closing years of the eighteenth century, line engraving attained a depth of colour and fullness of tone in which earlier works are often deficient, and during the following century it reached a perfectness of finish which it had not previously attained. A picture, whether figure or landscape, came to be translated by line engraving with all its depth of colour, delicacy of tone, and effect of light and shade; the various textures, whether of naked flesh, silk, satin, woollen, or velvet, were all successfully rendered by ingenious modes of laying the lines and combinations of lines of varying strength, width, and depth. At the same time, original work by engravers declined in quality. Among engravers who have produced historical works of large size and in the line manner the names of Raphael Morghen (1758-1833), Longhi (1766-1831), Anderloni (1784-1849), Garavaglia (1790-1835), and Toschi, in Italy; of Forster (1790-1872), Henriquel-

Dupont (born 1797), Bridoux (born 1812), and Blanchard (born 1819), in France; of John Burnet (1784-1808), J. H. Robinson (1799-1871), Geo. T. Doo (1800-80), J. H. Watt (1799-1807), and Lumb Stocks (1812-92), in England, stand pre-eminent. Among historical and portrait engravers in the stipple or dotted manner the names of H. T. Ryall, Henry Robinson, William Holl (1807-71), and Francis Holl may be mentioned. In the period 1820-60 landscape engraving attained a perfection in Great Britain which it had not attained in any other country, or at any other time. In fact, most of the work was done by etching, details being sharpened by the graver. Among landscape engravers the names of Geo. Cooke (1781-1834), William Miller (1796-1882), E. Goodall (1795-1870), J. Cousen (1804-80), R. Brandard (1805-62), and Wm. Forrest (born 1805) hold the foremost places. Most of these were associated with the reproduction of Turner's pictures, and owed much to his control and direction. In mezzotint engraving Samuel Cousins (1801-87) and David Lucas, who was associated with John Constable in the 'English Landscape' series, achieved considerable success. In the period 1830-45 various publications called *Annuals*, composed of light literature in prose and verse, and illustrated by highly finished engravings in steel, were very popular. The engravings were necessarily of small size, and are generally of great excellence. A number of them, both figure and landscape, are executed with such finish and completeness as to be esteemed perfect works. The illustrations of Rogers's *Poems* and Rogers's *Italy* after Turner and Stothard belong to this period. Many of the originals of the engravings in the *Annuals* were finished pictures of large size. A great part of the difficulty in engraving on a small scale from a large picture consists in determining what details can be left out, and still preserve the full effect and character of the original. The most noted engravers for work of this kind are Charles Heath, Charles Rolls, W. Finden, E. Finden, E. Portbury, J. Goodyear, F. Engleheart, Henry le Keux, E. Goodall, and W. Miller. Since 1870 many reproductions of paintings have been produced by means of etching, a comparatively cheap and rapid process. Such works have been fashionable and very popular with collectors. But while some of them have been excellent of their kind, the process is of limited resource, and the best works in this manner do not compare with the masterpieces of line engraving. In original work, however, etching and dry-point (q.v.) have produced some excellent work, notably in the hands of Charles Meryon, J. M. Whistler, Sir Seymour Haden, and Anders Zorn. A revival of mezzotint owes much to Sir Frank Short. Through lack of encourage-

ment, change of fashion, and the adoption of other methods of reproduction, line engraving on metal has become almost a lost art in Great Britain, though a revival in wood engraving has taken place of recent years.

*Line Engraving*, as implied by the term, is executed entirely in lines. The tools are few and simple. They consist of the graver or *burin*, the scraper, to remove the burr left by the graver, and the burnisher; an oil-stone or hone, dividers, a parallel square, a magnifying lens; a bridge on which to rest the hand; a blind or shade of tissue paper, to make the light fall equally on the plate, callipers for levelling important erasures, a small steel anvil, a small pointed hammer, and punches. In etching, the following articles are required: a resinous mixture called etching-ground, capable, when spread very thinly over the plate, of resisting the action of the acids used; a dabber for laying the ground equally; an etching needle; a hand-vice; some brushes of different sizes; and bordering wax, made of burgundy-pitch, bees'-wax, and a little oil.

In *etching*, the plate, which is highly polished and must be free from all scratches, is first prepared by spreading over it a thin layer of *ground*. The surface is then smoked, and the outline of the picture transferred to it by pressure from the paper on which it has been drawn in fine outlines by a black-lead pencil. The picture is then drawn on the ground with the etching-needle, which removes the ground in every form produced by it, and leaves the bright metal exposed. Sometimes, however, the drawing is made direct, without the use of tracing. A bank of wax is then put round the plate and diluted acid poured on it, which eats out the metal from the lines from which the ground has been removed, but leaves the rest of the plate untouched. (See also *Dry-point*.) In landscape engraving, as practised in England in the early nineteenth century, the plate is then gone over with the graver, the etched lines clearly defined, broken lines connected, new lines added, &c. Sometimes the plate is *rebitten* more than once, those parts which are sufficiently bitten in the first treatment being *stopped* with varnish, and only the selected parts exposed to after-biting. Finally the burnisher is brought into play alternately with the graver and point to give perfectness and finish. In engraving proper, the lines are first drawn on the metal with a fine point and then cut in by the graver, first making a fine line, and afterwards entering and re-entering till the desired width and depth of lines is attained. Much of the excellence of such engravings depends on the mode in which the lines are laid, their relative thickness, and the manner in which they cross each other. In this

method of engraving etching is but little used, if at all, and then only for accessories and the less important parts.

*Soft-ground Etching.*—The ground, made by mixing lard with common etching-ground, is laid on the plate and smoked as before, but its extreme softness renders it very liable to injury. The outline of the subject is drawn on a piece of paper larger than the plate. The paper is then damped, and laid gently over the ground, face upwards, and the margins folded over and pasted down on the back of the plate. When the paper is dry and tightly stretched, a bridge is laid across, and with a hardish pencil and firm pressure the drawing is completed in the usual manner. The pressure makes the ground adhere to the back of the paper at all parts touched by the pencil, and on the paper being lifted carefully off, these parts of the ground are lifted with it, and the corresponding parts of the plate thus left bare are exposed to the subsequent action of the acid. The granulated surface of the paper, causing similar granulations in the touches on the ground, gives the character of a chalk drawing. The biting-in is effected in the same manner as already described, and the subject may be finished by rubbing and dotting with the graver. See *Etching*.

*Stipple, or Chalk Engraving*, in its pure state, is exclusively composed of dots, made with a special form of graver, varying in size and form as the nature of the subject demands, but few stipple plates are now produced without a large admixture of line in all parts, flesh excepted. Etching is often used to put in the more important lines and tone masses.

The processes of *Aquatint* and *Mezzotint* will be found under their respective heads, the latter differing from all other styles of engraving in that the lights and gradations are scraped or burnished out of a plate prepared so that it would print quite dark all over, instead of the forms being corroded or cut into a plain surface.

The *Mixed Style* is based on mezzotint, which, still forming the great mass of shading, is in this method combined with etching in the darker, and stipple in the more delicate parts. By this combination a plate will produce a larger number of good impressions than it would if it were done entirely in mezzotint.

*Engraving on Wood.*—The wood best adapted for engraving is box. It is cut across the grain in thickness equal to the height of type, these slices being subjected to a lengthened process of seasoning, and then smoothed for use. Every wood engraving is the representative of a finished drawing previously made on the block, the unshaded parts being cut away, and the lines giving form, shading, texture, &c., left standing in relief by excavations of varied size and character,

made between them by gravers of different forms. Drawings on wood are made either with black-lead pencil alone or with pencil and indian ink, the latter being employed for the broader and darker masses. It is now much the practice to photograph drawings made in black and white upon the wood instead of making the drawing on the wood block. When the drawing is put on the wood by washes or by photography, instead of being entirely done by pencil lines, the engraver has to devise the width and style of lines to be employed instead of cutting in fac-simile, as is the case when the drawing is made entirely in lines. The tools required for wood engraving are similar but more numerous than those of the engraver on copper or steel. See also *Die-sinking*; *Gems*.—**BIBLIOGRAPHY:** W. Y. Ottley, *Early History of Engraving*; G. Duplessis, *History of Engraving in France*; P. G. Hamerton, *Graphic Arts*; F. Wedmore, *Fine Prints*; A. M. Hind, *A Short History of Engraving and Etching*; J. H. Slater, *Engravings and their Value*; H. C. Levis, *Engraving and Collecting of Prints*; *Bibliography*.

**Engrossing, Forestalling, and Regrating**, terms formerly in use for the purchase of corn or other commodities in order to sell again at a higher price, or in order to raise the market price of the same. The modern equivalent is 'making a corner'. These practices were once regarded as criminal, and positive statutes against them were passed in England in 1266-7, in 1350-2, in 1552, in 1562, and in 1370. The offence of *engrossing* was described by the statute of Edward III as the "getting into one's possession, or buying up, large quantities of corn, or other dead victuals, with intent to sell them again"; *forestalling*, as the "buying or contracting for any cattle, merchandise, or victual, coming in the way to the market, or dissuading persons from bringing their goods or provisions there, or persuading them to enhance the price when there"; and *regrating*, "the buying of corn or other dead victual in any market and selling it again in the same market, or within 4 miles of the place". By the statute of Edward VI the engrossing of corn, which included the buying of it in one market to sell it in another, was made punishable by imprisonment and pillory; and no one could carry corn from one part of the kingdom to another without a licence. All the positive statutes against these offences were repealed in 1772, but they were still found to be punishable by common law, and it was not till 1844 that they entirely ceased to rank among offences.

**Enharmonic**, in music, is an epithet applied to intervals smaller than the regular divisions of the scale, i.e. less than semitones. Enharmonic intervals can be produced on stringed instru-



ments, or on specially constructed fixed-tone instruments having more than twelve divisions in the octave.

**Enkhuizen** (engh'hoi-zu), a seaport of Holland, on a projection in the Zuider Zee, 20 miles north-east of Amsterdam. It had formerly a pop. of 40,000, but the silting up of the harbour has caused its decay, and its inhabitants number now about 7110.

**Enlistment**, the act of engaging oneself or another to perform any service. In general, the use of the word is confined to engagements for the public service, and more especially in the armed forces of the Crown. In earlier days enlistment of soldiers was either for an indefinite period, as, for instance, for a particular war or campaign, or for life. Up to the middle of the seventeenth century enlistments were made to serve the officer raising the force under a contract from the Crown; after this period all enlistments were to serve the king. In both cases they were for a particular regiment only. For the next hundred years troops continued to be raised both in peace and war on the contract system, which by now implied that the officer accepting the contract, in addition to having a considerable say in the matter of allotting commissions to his friends, received a lump sum to cover all expenses of recruiting, pay, and clothing, out of which he and his officers made what they could. The objections to such a system are palpable, and it was abolished in 1783, after which year all duties with regard to the enlistment of troops were placed in the hands of a Director of Recruiting and Organization. The contract system was last used in war as late as the fifties of the last century during the Crimean War. For some eighty years prior to 1847 the term of enlistment was ordinarily for life, but from that year onward to 1870 various systems of limited enlistment were in force. In 1870, with the idea of forming a reserve, the principle of short service was introduced by the Army Enlistment Act, and this principle has been continued by all succeeding legislation. The existing law as to enlistment is to be found in Part II of the Army Act, Sections 78 to 101; more detailed instructions are in the Recruiting Regulations. The Army Act, brought into force annually by the Army (Annual) Act, specifies the term of original enlistment to be twelve years, which may be either entirely in army (colour) service, or partly in colour service and partly in the reserve. In practice the normal terms are seven years' colour service and five years' reserve service for the infantry, with certain modifications in the case of other arms. Enlistment may be made for general service or for a particular corps, and in the latter case the recruit will be posted to that corps only, and will ordinarily

spend his whole service in it. A man desiring to enlist should present himself at a recruiting office, where he will be given a notice setting forth the terms of service. If, after reading the conditions, he still desires to enlist, he will be directed to appear before a justice of the peace (a recruiting officer is *ex officio* a justice of the peace for this purpose) for attestation. Attestation consists in giving signed answers to certain questions contained in the Form of Attestation, and in taking the oath of allegiance. The completed form is then signed by the justice, and the man becomes a properly enlisted and attested soldier. The former practice of giving a shilling to every prospective recruit, and thereafter considering him for some purposes a soldier, is no longer recognized, and, at any time before signing the attestation paper, the man may decline to complete his bargain without rendering himself liable to any penalty. Should he, however, make a false answer to certain of the questions contained in his attestation paper, he is liable to punishment on conviction by court-martial.

**Ennis**, a town (formerly a parliamentary borough) in Ireland, County Clare, on the Fergus, 10 miles north-west of Limerick. It is irregularly built, the streets being narrow and crooked. There are remains of a Franciscan abbey founded in 1240. Some linen and flannel are manufactured, and there is a trade in agricultural produce. Pop. 5472.

**Enniscorthy**, a town in Ireland, County Wexford, on the River Slaney, 77 miles south of Dublin. An old castle erected by one of the early Norman conquerors is in the centre of the town. Vinegar Hill in the immediate vicinity was the scene of a skirmish in 1798, when the town was stormed and burned by the rebels. Pop. 5495.

**Enniskillen**, a town (formerly a parliamentary borough), Ireland, County Fermanagh, 34 miles north-east of Sligo, on an island in the river which connects the upper and lower sections of Lough Erne, with suburbs on both sides of the adjoining mainland, with which it communicates by two bridges; a well-built, clean, thriving town. Pop. 4847.

**Ennius**, Quintus, the father of Latin poetry, was born at Rudiae, in Calabria, in 239 B.C., and died in 170 B.C. Like our own early poet Gower, he was trilingual, speaking Greek, Oscan, and Latin. He was of good family, and claimed descent from the legendary kings of Calabria. Little is known of his life; he served in the Second Punic War, and held the rank of centurion in 204 B.C.; at a later date he went to Rome, supported himself by teaching, and was friendly with the greatest of his contemporaries. He died of gout in his seventieth year. Ennius was a man of great versatility. He held perhaps



the foremost place among writers of tragedies at Rome. He wrote good comedies. He wrote satires, and prepared the way for Lucilius. He wrote didactic poetry, and prepared the way for Lucretius. Most important of all, he wrote epic poetry—the *Annales*—and prepared the way for Virgil. He was the first to transplant the hexameter into Italy. His predecessors wrote in a rough kind of verse scanned by accent rather than quantity, and known as 'Saturnian verse'. Ennius contemptuously called this "the verse of fauns and soothsayers", and introduced the strong-winged music of Homer into his verse. He also brought in the elegiac couplet, which was to attain perfection at the hands of Propertius and Ovid. He left a permanent impress on the language. He made a systematic study of orthography, and invented a system of shorthand. He was fond of philosophical speculations, and made the Romans acquainted with the rationalism of Euripides and Euhemerus. He was, therefore, a remarkably versatile and prolific writer. His translations from the Greek tragedians were of the greatest importance in the history of Roman drama. His chief fame, however, rests upon his *Annales*, a great epic in eighteen books. Like all of the works of Ennius, it only survives in fragments quoted by later writers. It was a great national epic, recording the history of the Roman state from the landing of Æneas down to the poet's own time. The city itself—*urbs quam dicunt Romam*—may he said to have been the central figure of his poem, a nobler figure than the pious Æneas. The verse of Ennius is sometimes crude and harsh, but it contains many fine lines and grand passages. Some of these lines are world-famous, like those on Fabius Maximus beginning with

Unus homo nobis cunctando restituit rem,  
or the great line

Moribus antiquis res stat Romana viisque,

which sums up some of the qualities which placed Rome at the head of the civilized world. In a famous simile Quintilian (*Inst. Or.* x, 1, 88) compares Ennius to a sacred grove of ancient oaks, whose massive immemorial trunks are awe-inspiring rather than beautiful. In his own epitaph Ennius boasted that he still lived as he passed to and fro through the mouths of men (*volito vivu' per ora virum*). Though his works are lost, this is still true, for he inspired Virgil and influenced all Latin literature.—BIBLIOGRAPHY: W. Y. Sellar, *Roman Poets of the Republic*; L. Müller, *Quintus Ennius*; J. W. Duff, *A Literary History of Rome*.

ENNS, a river in Austria, which rises in the Alps of Salzburg, flows N., then N.N.E., then

N.N.W., entering Upper Austria (Ober der Enns), which for 15 miles it separates from Lower Austria (Unter der Enns), and finally enters the Danube a little below the town of Enns (4438 inhabitants). Total course about 150 miles.

Enoch (ē'noh), (1) the eldest son of Cain, who called the city which he built after his name (*Gen.* iv, 17). (2) One of the patriarchs, the father of Methuselah. He "walked with God; and he was not; for God took him" (*Gen.* v, 24) at the age of 365 years. The words quoted are generally understood to mean that Enoch did not die a natural death, but was removed as Elijah was.

Enoch, Book of, an apocryphal book of an assumedly prophetic character, to which considerable importance has been attached, particularly on account of St. Jude quoting it in the 14th and 15th verses of his *Epistle*. It is referred to by many of the early Fathers; is of unknown authorship, but was probably written by a Palestinian Jew in Hebrew or Aramaic, was translated into Greek, and from the Greek the existing Ethiopic version was made in the first or second century B.C. Till the end of the eighteenth century it was known in Europe only by the references of early writers. On his return, Bruce, the African traveller, brought with him from Abyssinia two manuscripts containing the Ethiopic translation of it. In 1821 Archbishop Laurence published a translation of the work, and in 1838 the Ethiopic text followed. *The Book of Enoch* has since been repeatedly published, translated, and criticized.

Enos, a seaport in Thrace, 38 miles N.W. of Gallipoli, on the Ægean Sea, in the Gulf of Enos. Pop. 6940.—The Gulf of Enos is 14 miles in length by about 5 miles in breadth.

Enschede (ens'hc-dā), a town of Holland, province of Overijssel, near the Prussian frontier, the chief seat of cotton manufacture in Holland. It has increased rapidly in recent years. Pop. 41,000.

Ensenada (in Sp., a creek or natural harbour), a seaport of the Argentine Republic, province of Buenos Ayres, the port of the town of La Plata, with which it is connected by rail and tramway, with recently constructed harbour works.—Another place of the same name is a rising port of Mexico, in the northern part of the peninsula of California on the Pacific, in the Bay of Todos los Santos, with gold- and copper-mines adjacent.

Ensign, formerly, in the British army, the officer who carried the flag or colours of an infantry regiment; for this title, second lieutenant has been substituted since 1871. In naval language the ensign is the flag over the poop or stern which distinguishes the ships of different nations. In the Royal Navy of Britain it is a flag

with a white field divided into quarters by the red cross of St. George, and having the union (or Union Jack, as it is commonly called) in the upper corner next the staff. A similar ensign with a red field is flown by the merchant service.

En'silage, in agriculture, a mode of storing green fodder or vegetables in receptacles called 'silos'. These are usually pits of quadrangular form, lined with wood, brick, concrete, or stone. The fodder is cut and mixed, placed in the silo, pressed down, and kept compressed by heavy weights placed on a movable wooden covering. It undergoes a slight fermentation, and attains a slightly acid taste and smell, which is particularly grateful to cattle. The modern system of ensilage dates from about 1873, but the practice was known to the ancient Romans, and the system has been common in Mexico for centuries. Such advantages are claimed for it, as that in a wet season grass can be made into ensilage instead of hay, and that there is little loss of nutritive elements, while it has great feeding powers. Successful experiments have shown that green fodder may be converted into ensilage without a pit by simply piling up and consolidating by pressure.

Entablature (Lat. *in*, and *tabula*, a tablet), in architecture, the horizontal, continuous work which rests upon a row of columns, and belongs especially to classical architecture. It consists of three principal divisions — the *architrave* immediately above the abacus of the column, next the *frieze*, and then the *cornice*. In large buildings projections similar to and known also as entablatures are often carried round the whole edifice, or along one front of it.

Enta'da, a genus of leguminous plants, subord. Mimosæ, containing about a dozen species of climbing tropical shrubs, remarkable for the great size of their pods. *E. scandens* has pods which measure from 6 to 8 feet in length. They are sometimes carried from America to the coasts of Europe by the Gulf Stream. The seeds have a hard, woody, and beautifully polished shell, and are often made into snuff-boxes, scent-bottles, and other small articles.

Entail', in law, the settlement of an estate by which a freehold is limited to a person and the heirs of his body, with such particular restrictions as the donor may specify. Entailed estates are divided into *general* and *special*, the former when the estate is given to the donee and the heirs

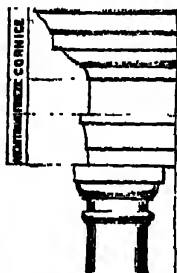
of his body without exception, the latter when the estate is limited to certain heirs to the exclusion of others. By a Bill introduced into Parliament in 1920 it is proposed that a tenant in tail should have power of disposal by will.

En'tasis, in architecture, the delicate and almost imperceptible swelling of the lower part of the shaft of a column, to be found in almost all the Grecian examples, adopted to give a more pleasing effect to the eye.

Entel'lus, an East Indian species of monkey, of the genus *Semnopithecus* (*S. entellus*). It has yellowish fur, with a face of a violet tinge, and a long and powerful tail, which, however, is not prehensile. It receives divine honours from the natives of India, by whom it is termed *Hanuman*. Costly temples are dedicated to these animals; hospitals are built for their reception, and large fortunes are bequeathed for their support. The entellus abounds in India; enters the houses and gardens of the natives, plunders them of fruit and eatables, and the visit is even considered an honour.

Entente Cordiale, a term applied in international politics to friendly relations existing between different countries and statesmen. It is not a formal alliance, but denotes the existing community of interests and friendly sentiments between two countries. The term has been especially applied to the friendly relations which existed between France and England ever since the reign of Edward VII down to the formal alliance concluded at the outbreak of the European War.

Enteric Fever, or Typhoid Fever, is an acute infectious fever, characterized by much general disturbance, and giving rise to ulceration in the small intestine. The distinction between this fever and typhus fever was only established in the middle of last century. It is due to a bacillus, difficult to detect, but during an attack found in many of the internal organs as well as in the stools, urine, and blood of the affected person. Enteric fever occurs in all parts of the world, and in most countries it is endemic, with occasional outbursts of epidemic prevalence. In Great Britain it is most common in the autumn, but epidemics may appear at any season. The great majority of cases occur between ten and twenty-five years of age; less common in middle life, it is rare after sixty. The most common source of infection is from the feces and urine of infected persons, hence the channels of infection are contaminated water, milk, and food-stuffs. Much public interest has been roused by the infection, through contaminated sewage-water, of water-cress, celery, oysters, and other shell-fish, and various outbreaks have arisen through these agents. A further danger is the 'enteric carrier', a person who has once had enteric fever, and who



Entablature of Tuscan Column

is harbouring the bacillus for many years in his gall-bladder or elsewhere, and whose stools and urine may be infectious for an indefinite period.

The incubation period is very variable, ranging from one to three weeks, while the onset of the disease itself is usually insidious. The patient complains of feeling out of sorts and of headache, soon followed by the signs of chill, due to the rising temperature, and associated with sleeplessness, occasionally severe head symptoms, and much digestive disturbance.

Attacks vary much in intensity, but during the first three weeks so-called mild cases may suddenly develop more severe symptoms. Convalescence is slow and protracted, as in severe cases emaciation and debility are marked. The chief complications during the acute stage of the illness are perforation of an ulcer through the bowel, demanding immediate surgical interference, and intestinal bleeding resulting from haemorrhage from an ulcer. During convalescence relapses are frequent, brought on by indiscretions of diet, chill, and undue exposure, or some unknown cause. The most common *sequelae* arising from the disease are thrombosis of a vein, usually in the thigh; bronchitis; one-sided parotitis; outbreaks of boils and superficial abscesses; and more occasionally heart weakness and disease of bone.

In its early stages enteric fever is difficult to diagnose, and confusion may arise between it and lobar- and broncho-pneumonia, influenza, diarrhoea associated with septic infection, typhus fever, appendicitis, or septicæmia.

In treatment, good nursing is of first importance. The patient must have suitable nourishment and stimulation, and requires to have the greatest care, whatever special form of treatment is being carried out, while constant watch must be kept for the appearance of any complication. Great differences in the treatment are observed in different countries and by different schools of medicine.

**Enteritis** (Gr. *enteron*, intestine) is inflammation of the intestines. It varies from a mild intestinal catarrh, causing slight symptoms, and yielding to treatment in a few days, to cases of severe vomiting and diarrhoea with extreme prostration. These severe forms are most frequently seen in infants and young children during the summer months, and frequently prove fatal. Removal of the cause of irritation and complete rest to the intestines are to be aimed at, as far as possible, in the treatment of the condition.

**Enteromorpha**, a genus of Green Algae, similar to *Ulva*, but with a tubular thallus. *E. intestinalis* is common in fresh and brackish waters.

**Entertainments Tax**, first imposed by the Finance (New Duties) Act, 1916, is an *ad valorem* duty on payments for admission of persons as

spectators or members of an audience to any entertainment. Entertainment is defined as including any exhibition, performance, amusement, game, or sport to which persons are admitted for payment. The tax is collected by means of stamped tickets of admission, or (in respect of places of regular entertainment, and in other cases on special cause shown) on the basis of returns furnished to the Board of Customs and Excise by arrangement previously made with the Board. Admission by complimentary ticket is not taxable if no indirect payment is a condition of such admission.

Exemption from the tax may be claimed in respect of any entertainment (1) where the gross receipts are entirely devoted to philanthropic or charitable purposes; or (2) where the purpose is the amusement of children, and the charge for admission does not exceed one penny per head; or (3) which is provided by or on behalf of a school or other educational institution for the furtherance of an object connected therewith, and at which the performers are children under sixteen years of age who have been or are in attendance thereat; or (4) which is wholly educational, or, being partly educational and partly scientific, is conducted by an association not established or carried on for profit, or, having for its aim the revival of national pastimes, is provided by such an association founded for that purpose.

Repayment of the tax may be claimed when the net proceeds of an entertainment are devoted to philanthropic or charitable purposes, and the total expenses met from the receipts do not exceed one-fifth of the receipts.

When admission to an entertainment is dependent upon payment of a contribution or subscription to a club, society, or association, tax is payable thereon, and where such payment carries with it the right of admission, the tax is due whether the right is exercised or not. If, however, the payment confers the right to other privileges besides admission to an entertainment, e.g. to the use of library, reading-room, &c., only such proportion thereof as the Board determines to represent the right of admission is taxable.

The amount yielded by the tax for the fiscal year 1916-7 was over £3,000,000, for 1917-8 nearly £5,000,000, while for 1919-20 it was approximately £10,485,000.

**Entomology**, the branch of zoology which treats of insects, the name being from Gr. *entōma*, animals 'cut in', the transverse division or segmentation of the body being their most conspicuous feature. The true insects are those animals of the phylum Arthropoda distinguished from the other classes of the phylum by the fact that the three divisions of the body—the head, thorax, and abdomen—are always distinct from

one another. There are never more than three pairs of legs in the perfect insect, and these are all borne upon the thorax. Each leg consists of from six to nine joints. The first of these is called

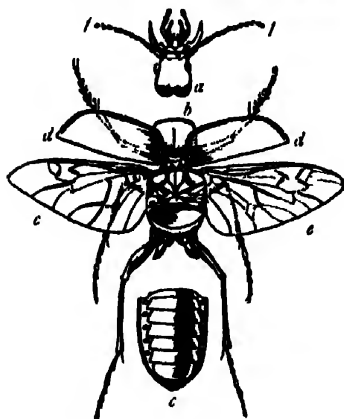
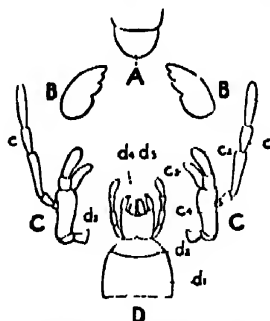


Diagram showing the Parts of Insect:

a, Head. b, Thorax. c, Abdomen. dd, Front wings ee hind wings. ff, Antennae.

the 'coxa', and is succeeded by a short joint called the 'trochanter'. This is followed by a joint, often of large size, called the 'femur', succeeded by the 'tibia', and this has articulated to it the 'tarsus', which may be composed of from one to five joints. Normally two pairs of

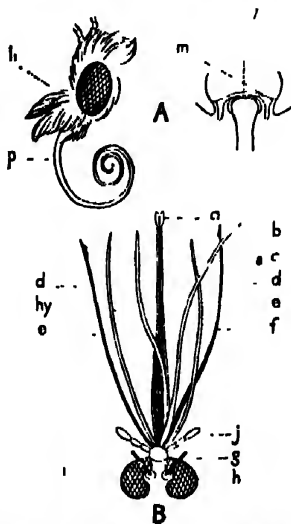


Biting Mouth Parts of an Insect

A, Upper lip. B, Mandibles. C, Maxillae:  $c_1$ , palp;  $c_2$ , gales;  $c_3$ , lacinia;  $c_4$ , stipes. D, Lower lip:  $d_1$ , submentum,  $d_2$ , mentum;  $d_3$ , labial palp;  $d_4$ , glossa;  $d_5$ , paraglossa.

wings are present, but one or other, or both, may be wanting. The wings are expansions of the sides of the second and third sections of the thorax, and are strengthened by narrow thickenings called 'nervures'. In the beetles the anterior pair of wings becomes hardened so as to form protective cases for the posterior membranous

wings, and are called in this condition 'elytra' or 'wing-cases'. The fore-wings are similarly transformed in the Orthoptera, while in many of the Hemiptera they are horny except at the tip. Respiration is effected by means of air-tubes or tracheae, which open on the surface of the body by lateral apertures called 'stigmata' or 'spiracles', and ramify through every part of the body. The head is composed of several segments amalgamated together, and carries a pair of feelers or 'antennae', a pair of eyes, usually compound (and often simple eyes in addition), and the appendages of the mouth.



A Sucking mouth of a Butterfly: p, proboscis, l, labium, lp, labial palps, m, mandibles. B, Piercing mouth of a Mosquito: a, labial palps, b, labium epi-pharynx, c, labium, d and e, maxillae, f, labrum, g, antennae, h and i, ocelli, hypopharynx; j, labial palp.

These last include an upper lip (labrum), and three pairs of jaws (mandibles, first maxillae, second maxillae), the third pair being more or less fused into a lower lip (labium). The thorax is composed of three segments, also amalgamated but generally pretty easily recognized. The abdominal segments are usually more or less freely movable upon one another, and never carry locomotive limbs; but the extremity is frequently furnished with appendages connected with generation, which in some cases serve as offensive and defensive weapons (stings). The organs of the mouth take collectively two typical forms, the masticatory and the suctorial, the former exemplified by the beetles, the latter by the butterflies, in which the mouth is purely for suction. The alimentary canal consists of the oesophagus or gullet, a crop, a gizzard, a stomach, and an intestine, terminating in a cloaca. There

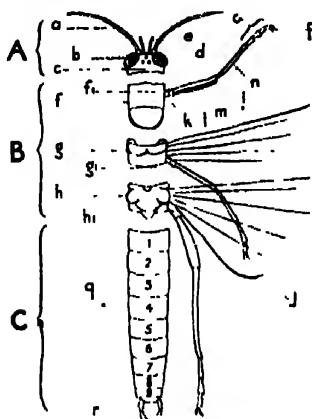
is no regular system of blood-vessels; the most important organ of the circulation is a contractile vessel situated dorsally and called the 'dorsal vessel'. The nervous system consists of a pair of cerebral ganglia (brain) in the head, these being the thickened upper part of a nerve-ring which encircles the gullet and passes below into a double ventral nerve-cord dilated into ganglia at intervals. The sexes are in different individuals, and most insects are oviparous. Reproduction is

is worm-like and the pupa quiescent. The section Ametaböla includes the order Aptëra (tassel-tails and spring-tails). The section Hemimetaböla comprises the orders Hemiptëra (cicadas, bugs, plant-lice, &c.), Orthoptëra (cockroaches, crickets, grasshoppers, locusts, earwigs, &c.), and Neuroptëra (dragon-flies, may-flies, white-ants, &c.). The Holometaböla comprises the orders Diptëra (gnats, bot-flies, gad-flies, mosquitoes, house-flies, fleas, &c.), Lepidoptëra (butterflies and moths), Hymenoptëra (bees, wasps, and ants), and Coleoptëra (lady-birds, glow-worms, cockchafers, weevils, and all of the beetle tribe). A division is sometimes made into Mandibulate and Haustellate groups, the oral apparatus of the former being adapted for mastication, the latter for imbibition of liquid food. Both types are, however, sometimes modified, and occasionally combined.

**Entomoph'aga** ('insect eaters'), a term applied to (1) a group of hymenopterous insects whose larvæ feed upon living insects; (2) a tribe of marsupials, as the opossums, bandicoots, &c., which are insectivorous, though not exclusively so; (3) a section of the edentates, as the ant-eater and pangolin.

**Entomophthorineæ**, a curious family of Fungi, group Zygomycetes, all parasites on insects. The best known is *Empusa Muscæ*, which attacks the common house-fly. After thoroughly penetrating and finally killing the infected fly, the fungus sends numerous hyphæ to the surface, from the ends of which conidia are shot forth by an 'explosive' process, to spread the infection if they alight on living flies. In autumn, flies killed by this parasite may often be found adhering to window-panes, surrounded by a halo of ejected conidia. It has been proposed to utilize this fungus in combating the fly nuisance.

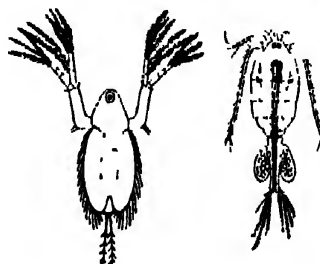
**Entomos'traca**, a sub-class of crustacea, including forms which are mostly small, and com-



Structure of a Hexapod

A, Head *a*, antennæ, *b*, compound eyes, *c*, ocelli, *d*, ocelli; *e*, palpi. B, Thorax *f*, pronotum, *f*<sub>1</sub>, prothoracic legs, *g*, mesonotum, *g*<sub>1</sub>, mesonotal leg, *h*, metathorax, *h*<sub>1</sub>, metathoracic leg, *i*, mesothoracic, and *j*, metathoracic wings; *k*, coxa of leg; *l*, trochanter, *m*, femur, *n*, tibia, *o*, tarsus, *p*, ungues. C, Abdomen *q*, body segments, *r*, genitalia

generally sexual, but non-sexual reproduction also occurs. (See *Parthenogenesis*.) Generally the young are very different from the full-grown insect, and pass through a 'metamorphosis' before attaining the mature stage. When this metamorphosis is complete, it exhibits three stages that of the larva, caterpillar, or grub, that of the pupa or chrysalis, and that of the imago or perfect winged insect. Insects have been divided into three sections—Ametaböla, Hemimetaböla, and Holometaböla, according as they undergo no metamorphosis, an incomplete one, or a complete one. The young of the Ametaböla differ from the adult only in size. They are all destitute of wings; the eyes are simple and sometimes wanting. The Hemimetaböla undergo an incomplete metamorphosis, the larva differing from the imago chiefly in the absence of wings and in size. The pupa, here termed a nymph, is usually active, or, if quiescent, capable of movement. In the Holometaböla the metamorphosis is complete, the larva, pupa, and imago differing greatly from one another in external appearance and habits. The larva

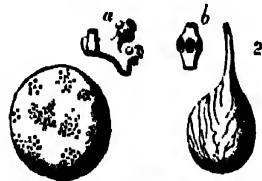


Spiny-tailed water-flea (*Daphnia*) on left, *Cyclops* on right. Both enlarged

prising four orders: (1) Branchiopoda, brinshrimps and water-fleas; (2) Copepoda, including the freshwater Cyclops, and numerous marine

species contributing to the floating surface population (plankton); (3) Cirripedia, barnacles; (4) Ostracoda, types such as Cypris enclosed in a bivalve shell.

Entozo'a, a general name for the various parasitic worms that infest the bodies of other animals. Some are found in the intestines, others in the liver, brain, muscles, and other tissues. They pass through different stages in their development, and at each stage may occupy a different organ (or tissue), and usually a different animal. Thus the cystic or bladder-worm, whose presence in the brain of sheep causes staggers, is the immature form of a tapeworm of the dog, &c. The number of species is being reduced as the relations of the different forms are studied. They belong to the two phyla Platyhelminthes (flat-worms) and Nematelminthes (thread-worms, &c.). The former



Entozoa magnified

1, *Cœnurus cerebralis* (producing the staggers in sheep) a, Heads (shown on the surface) separately 2, *Cysticercus cellulosus* (causing the measles in pigs). b, Head.

embraces flukes (Trematoda) and tapeworms (Cestoda); while the latter includes thread-worms and round-worms (Nematoda), and spiny-headed worms (Acanthocephala).

**Entrenchments.** The employment of entrenchments, or earthworks, in connection with military operations dates from the earliest times. Entrenched camps, made by the Romans, are still to be seen in many parts of the country. The primary object, in early designs, was to offer a material obstacle to the assaulting enemy; the defenders manned a high parapet overlooking a formidable ditch, and a hand-to-hand conflict decided the issue. The development of fire-arms, and especially of artillery, depreciated the value of entrenchments as affording material obstacles, but gave them a gradually increasing value as a means of protecting the defenders from missiles. The provision of cover, that is to say, concealment from view or protection from fire, ultimately became the dominant factor in the design of earthworks. Obstacles were still necessary, but they had to be provided by other means. Successive improvements in fire-arms altered the nature of the cover which it was necessary and practicable to provide. A bullet-proof parapet has always been an essential feature, but whereas a few inches of earth suf-

ficed to stop a musket-ball, the modern rifle-bullet will penetrate a thickness of nearly four feet. The introduction, during last century, of shrapnel shell, the bullets from which descend at a steep angle, was followed by the adoption of overhead cover as a standard feature in trench design. This persisted for several years, until the great increase in the power of high-explosive shell made it impossible to construct any form of roof which would withstand bombardment, even by the lighter artillery accompanying an army in the field, and still permit of the defenders using their rifles from below it. Modern fire-positions are made open, i.e. without overhead cover.

All past wars have proved that victory can only be won as the result of offensive action. Nevertheless, in any campaign it will not be possible to attack at all times and in all places. The provision of the strongest possible force at the vital point necessitates a defensive attitude on other parts of the front. Although entrenchments presuppose a defensive attitude locally, they play an important part in offensive operations. The ultimate aim is that, by a skilful use of entrenchments, a commander may be able to reduce to a minimum the strength of his force in actual combat with the enemy, and thus to retain at his disposal a reserve of troops for offensive action.

Entrenchments may be either hasty or deliberate. Hasty entrenchments are those made on the actual field of battle: by the attackers, to secure the ground won prior to another bound forward; by the defenders, to hold up the attack pending fresh dispositions of troops in rear. The amount of digging that can be done is necessarily small; existing cover must be utilized to the utmost. This may consist of ditches, hedges, sunken roads, railway embankments and cuttings, buildings, woods, shell-holes, &c. All of these are readily convertible into strong defences. The test of battle has proved, over and over again, that troops well trained in adapting natural cover to defence are very difficult to dislodge, once they have dug themselves in. Deliberate entrenchments are employed in the gradual building up of a trench system when once the opportunity of manœuvre has ceased to exist; or in the preparation of a defensive position somewhat remote from the scene of active operations.

The following are the salient features in the design of modern entrenchments: (1) A parapet 18 inches high, and upwards of 5 feet thick, in front of every fire-trench. (2) Longitudinal division of every trench, either by projecting buttresses of earth or by bends, so that no straight portion exceeds 10 yards in length. The effect of this is to give protection against

flanking or enfilade rifle-fire, and to localize the burst of shell. (3) A parapet on the rear side (parados), to shield the defenders from the back-blast of shell which burst beyond the trench. (4) Wide trenches (6 feet at the top), to minimize the risk of men getting buried during bombardment. (5) Accommodation, in dug-outs and other refuges, for a proportion of the troops.

Arms of precision have, during the past twenty years, compelled careful attention to the concealment of entrenchments. Although systems of trenches cannot now be hidden from the eye of the aeroplane-camera, yet the enemy can be kept in doubt, by correct design and careful siting of trenches, as to the strength in which the various portions of a position are held. It is for this reason that the deep fire-trench, with a low parapet in front, has been universally adopted, despite the obvious objection that minor undulations restrict the field of fire because the rifle is brought nearer to the ground. Earth-works on a sky-line, or those seen by the enemy against a distant background, violate the first principles of siting.

Modern entrenchments are arranged in depth. The 'lines' of Wellington's time have given place to a broad belt of mutually supporting defences, organized in three zones. These merge imperceptibly into one another, and each zone extends upwards of a mile from front to rear. The foremost fringe of the outpost zone is in contact with the enemy; it is the high-water mark on which the troops advancing during the last action have come to a standstill and dug themselves in. Very lightly manned, as befits an area where heavy shelling is rife, this zone, nevertheless, plays an important rôle. It harbours the forward artillery observation posts, which control and direct the fire of the guns in rear. It furnishes a 'jumping-off' place for attacks. It takes the first shock of a hostile attack, and, although not strong enough to repulse a serious offensive, contributes to the enemy's ultimate defeat by depriving his onslaught of momentum. The battle zone is more elaborately organized, and capable of being very heavily manned. Within this area the defence intend to bring to a standstill the most determined offensive. It lies sufficiently far back from the fringe of the outpost zone to be reasonably immune from destructive bombardment. Lying still farther back is the third zone, which serves for the accommodation of reserves of troops, and is also prepared for defence, as a last resort, in case the enemy should penetrate the battle zone.

Entrepôt (an-tr-pô; Fr.), a port where foreign merchandise which cannot enter the interior of a country is deposited in magazines under the surveillance of the custom-house officers till it is

re-exported; also, any place where goods are sent to be distributed wherever customers are found.

Entre Ríos (en'tre rê'os; 'between rivers'), a province of the Argentine Republic, lying between the Uruguay and the Paraná; area estimated at 29,240 sq. miles; pop. 425,370. The province is largely pastoral. Capital, Paraná, with a pop. of 25,000.

Entropion is the inversion or turning in of the eyelid. It may be congenital, or arise as the result of some inflammatory process or burn of the conjunctiva. Entropion affecting the lower lid appears also as the result of extreme photophobia (intolerance to light).

Entropy, a term introduced into physics by Clausius as the name of one of the two important thermodynamical properties of a substance which depend on its 'state'. Suppose we have 1 lb. of water at atmospheric pressure and 212° F., say, and suppose we apply heat to the water and change it into 1 lb. of steam at 212° F. The temperature does not change during this process, while the heat which must be added is the latent heat of the steam, namely, about 900 British Thermal Units. The increase of entropy from the first state to the second state is got by dividing the heat given to the substance, namely, 900 B.Th.U., by the absolute temperature at which that heat was given to the substance, namely, 461 + 212 = 673 degrees absolute, i.e. the increase of entropy is  $900 \div 673 = 1.43$  units. If the temperature changes

with the addition of heat, as it would usually do, we have to imagine the heat to be supplied in small quantities, and to take the average temperature of the body at which these tiny quantities of heat are supplied. The quotient heat-temperature is taken for each small quantity of heat, and the results are added together. The summation is defined as the increase in entropy between the initial and the final states.

In mathematical language the increase in entropy between state A and state B is given

by  $(\phi_2 - \phi_1) = \int_A^B \frac{dQ}{T}$ , where  $\phi$  stands for the

entropy, Q for the heat received by the body, and T for the absolute temperature at which the heat is received. The importance of the entropy function, namely, the integral  $\int \frac{dQ}{T}$ , in

thermodynamics is due to the fact that it is, like the internal energy of the substance, a function of the state of the substance only, and consequently in any temperature cyclic change in which the final state of the substance is the same as its initial state A, the total change, either of its internal energy or of its entropy,



is zero. The fact that the total change in the internal energy of the substance is zero is practically equivalent to the *First Law of Thermodynamics*, while the fact that the total change of the entropy of the substance is zero is equivalent to the *Second Law of Thermodynamics*.—**BIBLIOGRAPHY:** J. H. Poynting and J. J. Thomson, *Textbook of Physics* (vol. 3): *Heat*.

**En'velopes**, the paper covers that enclose letters or notes. They became common shortly after the introduction of the penny postage system; were at first made chiefly by hand, but are now not only shaped, but folded and gummed, by machinery.

**Enver Pasha**, Turkish soldier and politician, born at Constantinople in 1870. He entered the Turkish army in 1890, and in 1905 took part in the Young Turk movement at Salonica. He joined the revolutionaries in 1908, was for a short time military attaché in Berlin, but in 1909 returned to Salonica, and assisted in the deposition of Sultan Abdul Hamid. He then took part in the Tripoli War and the second Balkan War, and recaptured Adrianople from the Bulgarians in July, 1913. After being Minister of War, Enver subsequently became one of the leaders of the Committee of Union and Progress. A staunch pro-German, he was to a great extent responsible for Turkey's entry into the European War as an ally of Germany. After the armistice of 1918, Enver Pasha fled to the Caucasus, and was active in inciting his countrymen to resist the terms of the Peace Treaty of 1920.

**Environment**, in biology, the surroundings of an organism, including non-living factors, such as climate and weather; and also other organisms. Plants and animals are more or less adapted to their surroundings, a good example being the mutual adaptations of flowers and insects, but there has been much controversy as to the way in which such adaptations have come about. Among all but unicellular organisms any individual consists of (1) a general body (*soma*), by which the life of the individual is maintained, and (2) germ cells, capable of becoming fresh individuals, and thus providing for the continuance of the species. According to a school of thought founded by some of the pre-Darwinian evolutionists, notably Buffon, Lamarck, and Treviranus, modifications of the soma (acquired characters) of an individual, brought about by the action of the environment (e.g. thickening of parts of the skin as the result of constant pressure), or by use and disuse (e.g. increased size of muscles; diminished wings of poultry), can be inherited, leading to increasing alteration capable of ending in the production of new species. Most living biologists, however, hold with Weismann that only *germinal variations*, i.e. variations in the substances of the germ-

cells, are heritable. Much further research is necessary before it is possible to pronounce with certainty on many of the complex details involved in these theories. As to the part played by the environment, cases are known where this acts directly on the germ-cells, so as to influence their variation. But these are among some of the lower animals, in which the eggs develop outside the body of the parent, and we know hardly anything about the action of the environment on germs that develop internally. It has been suggested that modifications of the soma undoubtedly brought about by the influence of the surroundings may react upon the germ-cells and cause these to vary, but of this no proof has so far been forthcoming. Even if we admit that modifications of the soma are not inherited, they may nevertheless play a part in evolution by aiding the development of germinal variations that take the same direction. The whole subject is one of more than academic interest, especially in regard to the further evolution of human beings. Comparatively rapid advance, either in desirable or undesirable directions, would be possible if modifications acquired by the soma of an individual were capable of being inherited. So far as we know at present, acquired improvements in physique and mentality of individuals are not inherited by their offspring, which seems rather disappointing, but, on the other hand, undesirable modifications, including those due to disease, appear to be in the same case, and there is little reason to think that the children of parents possessing undesirable acquired characters are unduly handicapped from the very start. We must, of course, exclude cases of antenatal infection by the microbes of certain infectious or contagious diseases to which one or both parents have fallen victims, and also those of direct poisoning of germ-cells as the result of alcoholism.

**En'voy**, a person deputed by a Government to negotiate a treaty, or transact other business, with a foreign Government. We usually apply the word to a public minister sent for one particular purpose; hence an *envoy* is distinguished from an *ambassador*, and is of inferior rank.

**Enzymes**. See *Fermentation*, *Physiological Chemistry*.

**E'ocene**, in geology, a term applied to the lower division of the Tertiary strata, from Gr. *ēōs*, dawn, and *kainos*, recent, because remains of existing organic species first occur here. The Eocene beds are arranged in two groups, termed the Lower and Upper Eocene; the strata formerly called Upper Eocene being now known as Oligocene. They consist of marls, limestones, clays, and sandstones, and are found in the Isle of Wight and in the south-east of England and north-west of France, in Central Europe, Western

Asia, Northern Africa, and the Atlantic coast of North America.

**Éon de Beaumont.** See *D'Éon de Beaumont*.

**E'os**, among the ancient Greeks the goddess of the dawn. See *Aurora*.

**Eötvös** (cut'veush), Baron Joseph, a Hungarian statesman and author, born 1813, died 1871. He completed his studies at the University of Pesth in 1831. He had already, before leaving the university, produced three dramas—*The Critics*, *The Wedding*, and *Revenge*—the last a tragedy, all of which were well received. He became a friend of Kosuth, and distinguished himself as a journalist and orator of the popular party. In 1848, after the revolution of 15th March, he was appointed Minister of Public

with many bracts, a tubular corolla with smooth limb, stamens affixed to the corolla, and a five-valved many-seeded capsule. The species are shrubby plants, with axillary, white, red, or purple flowers, generally in leafy spikes. Among those cultivated in Britain we may mention *E. grandiflora*, which has flowers nearly an inch in length, of a brilliant reddish purple at the base and pure white at the apex. The order Epacridaceae consists of plants allied to the heaths, chiefly natives of Australia. The fruit of some species is eaten under the name of Australian cranberry, and they are cultivated in greenhouses for their flowers.

**Ep'act** (Gr. *epakto*, added), in chronology, the excess of the solar month above the lunar



Map of Eocene System in England

Instruction, resigned the same year, but was again appointed Minister of Public Instruction in 1867, and filled this office until his death. Among his works are the novels: *The Carthusian*, *The Village Notary* (translated into English), and *Hungary in 1514*—giving vivid pictures of Hungarian life in modern and more remote epochs.

**Eozo'ic Rocks**, the name given to the pre-Cambrian rocks, from their containing the first or earliest traces of life in the stratified systems.

**Eozo'on**, a supposed gigantic fossil foraminifer found in the limestone of the pre-Cambrian rocks of Canada, whence the name *Eozo'on canadense*. The structure, however, which is recognized also in Bavaria and in County Galway, has proved to be due to a zonal development of serpentine during metamorphism of the ancient limestones concerned. A similar structure occurs in limestone associated with the volcanic focus of Vesuvius.

**Ep'acris**, a genus of gamopetalous Dicotyledons, the typical genus of the nat. ord. Epacridaceae, distinguished by having a coloured calyx

synodical month, and of the solar year above the lunar year of twelve synodical months. The epacts then are *annual* and *menstrual* or *monthly*. Suppose the new moon to be on the 1st of January: the month of January containing 31 days, and the lunar month only 29 days, 12 hours, 44 minutes, 3 seconds; the difference, 1 day, 11 hours, 15 minutes, 57 seconds, is the *menstrual epact*. The *annual epact* is nearly 11 days; the solar year being 365 days, and the lunar year 354. The epacts were one of some importance in ecclesiastical chronology, being used for finding when Easter would fall.

**Epaminon'das**, an ancient Greek statesman and general, who, for a short time, raised his country, Thebes, to the summit of power and prosperity. He was born about 418 B.C., and killed at the battle of Mantinea, 362 B.C. He took the leading part in the struggle during which Spartan supremacy in Greece was destroyed, and the supremacy of Thebes temporarily secured. Four times he successfully invaded the Peloponnesus at the head of the Thebans, but after his

death Thebes soon sank to her former secondary condition. Throughout life Epaminondas was distinguished for the friendship subsisting between him and Pelopidas, with whom he served in the Spartan campaign, 385 B.C. His character is one of the finest recorded in Greek history, and his virtues have been praised by both Xenophon and Plutarch.

**Eparch** (ep'ark), in Greece, the governor or prefect of a provincial division called an *eparchy*, a subdivision of a nomarchy or province of the kingdom. In Russia, an *eparchy* is the diocese or arch-diocese of a bishop or archbishop of the Greek Church.

**Epaulement** (e-pa'l'ment; Fr. *épaule*, shoulder), in fortification, a term for the mass of earth or other material which protects the guns in a battery in front and on either flank.

**Ep'aulet**, or **Ep'aulette** (Fr. *épaulette*, dim. of *épaule*, the shoulder), an ornamental shoulder-piece belonging to a military or other dress. Ep'aulettes were worn in the British army till 1855, and in the United States as late as 1872, and are still worn in the navy by all officers of and above the rank of lieutenant, and by some civil officers.

**Épée** (é-pā), Charles Michel, Abbé de l', French philanthropist, born in 1712, died 1789. He had chosen the clerical profession, but had to leave the Church on account of Jansenist opinions. The great object of his life was the instruction of the deaf and dumb, upon whom he spent his whole income, besides what was contributed by benevolent patrons. In 1770 he founded at his own expense an institution for the deaf and dumb. He left several works on his method of instruction, one of these being *Institution des sourds et muets* (1774).

**Épéhy**, a town of France, department of Somme, about 18 miles S.E. of Cambrai. It was the scene of fierce fighting during the European War, and was captured by the British in Sept., 1918.

**Epeira** (e-pl'ra), a genus of spiders, comprising the largest and best-known British species. *E. diadema*, the common garden spider, is a handsomely marked species, which constructs a beautifully symmetrical wheel-shaped web.

**Eperies** (ep'er-yāsh), a town of Czechoslovakia, formerly in Hungary, on the Tereza, the seat of a Greek Catholic bishop. Pop. 16,823.

**Épernay** (ep'er-nā; ancient Sparnacum, and the Roman Aquæ Perennes), a town of North-Eastern France, department of Marne, on the Marne, the central depot of the wine trade of Champagne. The vast wine-cellars of the town form a labyrinth of galleries cut in the tufa or calcareous soil of the district. Épernay was occupied for a short time by the Germans at the beginning of the European War, and was

one of the enemy's objectives in the second battle of the Marne (July, 1918). Pop. 21,811.

**E'phab**, or **Bath**, a Hebrew measure of capacity, containing, according to one estimate or calculation, 8,6696 gallons; according to another, only 4,4286 gallons.

**Ephedra**, the principal genus of the Gnetales family of Gymnosperms. The species are shrubby switch-plants, natives of the warm temperate zone, found especially on sandy soil. The ripe seeding cones have fleshy scales, and those of *E. distachya* are eaten in South Russia.

**Ephem'era**, the typical genus of the neurop-terous insects constituting the family Ephemeridæ, so named from the extreme shortness of their lives in the perfect state. They are known as *may-flies* or *day-flies*, and are characterized by the slenderness of their bodies; the delicacy of their wings, which are creet and unequal, the anterior being much the larger; the rudimentary condition of the mouth; and the termination of the abdomen in three filiform appendages. In the state of larvæ and pupæ they are aquatic and exist for years. When ready for their final change, they creep out of the water, generally towards sunset of a fine summer evening, beginning to be seen generally in May. They shed their whole skin shortly after leaving the water, propagate their species, and die, taking no food in the perfect state. The may-fly is well known to anglers, who imitate it for bait.

**Ephes'ians**, **The Epistle to the**, a canonical epistle addressed by the Apostle Paul to the Church which he had founded at Ephesus. It was written during his first captivity at Rome, immediately after he had written the *Epistle to the Colossians* (A.D. 62); and was sent by the hands of Tychicus, who also bore the message to the Church at Colossæ.

**Eph'esus**, an ancient Greek city of Lydia, in Asia Minor, one of the twelve Ionian cities, on the south side of the Caystrus, near its mouth. It was at one time the grand emporium of Western Asia, having a convenient and spacious harbour. The Apostle Paul visited Ephesus and established a Christian Church there, to which he dedicated one of his Epistles. It was famous for its temple of Artemis (Diana), called *Artemision*, the largest and most perfect model of Ionic architecture, and reckoned one of the seven wonders of the world. The first great temple, begun about 650 B.C. and finished after 120 years, was burnt by the notorious Herostratus in order to perpetuate his name, 356 B.C. (the night of Alexander the Great's birth). A second and more magnificent was then erected, which was burned by the Goths in A.D. 262. Some interesting remains have been discovered by excavation since 1896. Several Church councils were held here, especially the Third

Koumenical Council of 431, at which Nestorius was condemned. The site of the city is now desolate; near it is a poor village, Aiasoluk.

Eph'od, a species of vestment worn by the Jewish high-priest over the second tunic. It consisted of two main pieces, one covering the back, the other the breast and upper part of the body, fastened together on the shoulders by two onyx stones set in gold, on each of which were engraved the names of six tribes according to their order. A girdle or band, of one piece with the ephod, fastened it to the body. Just above the girdle, in the middle of the ephod, and joined to it by little gold chains, rested the square breastplate with the Urim and Thummim. The ephod was originally intended to be worn by the high-priest exclusively, but a similar vestment of an inferior material seems to have been in common use in later times among the ordinary priests.

Eph'ors, or Eph'ori (Gr. *ephoroi*, overseers), magistrates common to many Dorian communities of ancient Greece, of whom the most celebrated were the Ephori of Sparta. They were five in number, were elected annually, and both the judicial authority and the executive power were almost entirely in their hands. Their power became an intolerable burden, especially to the kings, and in 225 B.C. Cleomenes III murdered the whole college and abolished the office.

Ephraem Syrus, that is, 'Ephraim the Syrian', writer of the Syrian Church, born at Nisibis, in Mesopotamia, about A.D. 306, died at Edessa in 373 or 378. He wrote several commentaries on Scripture, numerous homilies, and other works (as well as hymns), which have come down to us partly in Syriac, partly in Greek, Latin, and Armenian translations. They were edited by Assemani at Rome between 1732 and 1740, and by Overbeck at Oxford in 1805.

Ephraim, the younger son of Joseph, and the founder of one of the twelve tribes of Israel. When the Israelites left Egypt, the Ephraimites numbered 40,500, and their possessions in the very centre of Palestine included most of what was afterwards called Samaria. Ephraim is also a town mentioned in *John*, xi, 54, and to which Jesus retired after His raising of Lazarus, when the Jewish authorities manifested their hostility against Him.

Epic, a poem of the narrative kind, dealing with a series of events or actions of permanent interest. Some authorities restrict the term to narrative poems written in a lofty style and describing the exploits of heroes. Others widen the definition so as to include not only long narrative poems of romantic or supernatural adventure, but also those of an historical, legendary, mock-heroic, or humorous character. Epic poetry is distinguished from drama in so far

as the author frequently speaks in his own person as narrator; and from lyrical poetry by making the predominant feature the narration of action rather than the expression of emotion. Among the more famous epics of the world's literature may be noted: Homer's *Iliad* and *Odyssey*, Virgil's *Aeneid*, the German *Nibelungenlied*, the Anglo-Saxon poem of *Beowulf*, the French *Song of Roland*, Dante's *Divina Commedia*, Tasso's *Gerusalemme Liberata*, Ariosto's *Orlando Furioso*, Milton's *Paradise Lost*, Spenser's *Faerie Queene*, Camoens' *Lusiads* (Portuguese), and Firdusi's *Shah Namah* (Persian). Hesiod's *Theogony*, the *Elder Edda*, the Finnish *Kalevala*, and the Indian *Mahabharata* may be described as collections of epic legends. The historical epic has an excellent representative in Barbour's *Bruce*; and specimens of the mock-heroic and humorous epic are found in *The Battle of the Frogs and Mice*, *Reynard the Fox*, Butler's *Hudibras*, and Pope's *Rape of the Lock*. —BIBLIOGRAPHY: Chassang and Marcou, *Les Chefs-d'œuvre épiques de tous les peuples*; W. M. Dixon, *English Epic and Heroic Poetry*; A. Lang, *Homer and the Epic*.

Epicharmus (ep-i-kar'mus), a Sicilian comic poet and philosopher of the Pythagorean school, born in the Island of Cos about 540 B.C., died 450 B.C. He removed to Syracuse, where at the court of Hieron he spent the remainder of his life. He is credited with the invention of written comedy, and Plato called him "a master of the comic type".

Epictetus, a Greek Stoic philosopher, born at Hierapolis, in Phrygia, about A.D. 60. He lived long at Rome, where, in his youth, he was a slave. Though nominally a Stoic, he was not interested in Stoicism as an intellectual system; he adopted its terminology and its moral doctrines, but in his discourses he appeared rather as a moral and religious teacher than as a philosopher. His doctrines approach more nearly to Christianity than those of any of the earlier Stoics, and although there is no trace in what is recorded of them of his having been directly acquainted with Christianity, it is at least probable that the ideas diffused by Christian teachers may have indirectly influenced them. The excellence of his system was universally acknowledged. When Domitian banished the philosophers from Rome (A.D. 94), Epictetus retired to Epirus, where he is supposed to have died. His disciple Arrian collected his opinions, which are preserved in two treatises called the *Discourses of Epictetus*, and the *Manual or Enchiridion*.

Epicurus, a Greek philosopher, founder of the Epicurean school, was born in the Island of Samos 342 B.C., died at Athens 270 B.C. He settled at Athens 306 B.C., and purchased a garden

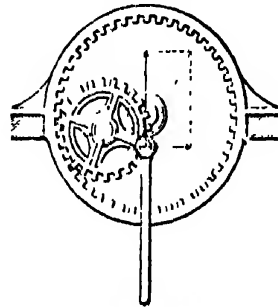
in a favourable situation, where he established a philosophical school. Here he spent the remainder of his life, living in a simple manner and taking no part in public affairs. His pupils were numerous and enthusiastically devoted to him. His theory of the universe was based on the atomic theory of Democritus. The fundamental principle of his ethical system was that pleasure and pain are the chief good and evil, the attainment of the one and the avoidance of the other of which are to be regarded as the end of philosophy. The term 'Epicurean' has come to signify one who is indulging his sensual appetites without measure, but this is really due to a misapprehension of the meaning of the word pleasure as used by the philosopher. Epicurus himself was not an 'Epicurean' in this sense, for he endeavoured to give a moral tendency to this doctrine. He exalted the pure and noble enjoyments derived from virtue, to which he attributed an imperishable existence, as incalculably superior to the passing pleasures which disturb the peace of mind, the highest good, and are therefore detrimental to happiness. Peace of mind, based on meditation, he considered as the origin of all good. It is, however, easy to see that his use of the word 'pleasure' was calculated to produce the mischievous results with which Epicureanism has been charged. The philosophy of Epicurus has, therefore, been violently opposed and frequently misrepresented; but while it is not open to the charges of gross sensualism which have been brought against it, it cannot be considered as much better than a refinement of sensualism. In ancient times his philosophy appears to have been more popular in Greece than in Rome, although his disciples were numerous in both, and the Latin poem of Lucretius, *De Rerum Natura*, is a poetical exposition of his doctrines. Epicureanism was resuscitated in France by Pierre Gassendi, and its principles have been professed by De la Rochefoucauld, Rousseau, and Voltaire. Epicurus was a very voluminous writer, but few of his writings are extant, what we possess comprising only some fragments of a *Treatise on Nature*, two letters, and detached passages. Lucretius, Cicero, Pliny, and Diogenes Laertius are our chief authorities for his doctrines.—BIBLIOGRAPHY: Lange, *History of Materialism*; W. Wallace, *Epicureanism*; Guyau, *La Morale d'Epicure*; Taylor, *Epicurus*; W. Pater, *Marius the Epicurean*.

**Epicycle**, a conception of the ancient astronomy used to explain the irregular, and at times retrograde, motions of the planets. Corresponding to each planet there was supposed to be a circle called a *deferent*, which had the earth as its centre. Round this circle a point was imagined to revolve with uniform motion. That

point formed the centre of a second and smaller circle, called an *epicycle*, and the actual planet was supposed to revolve with uniform motion round the circumference of the epicycle.

**Epicycloid**, in geometry, a curve generated by a point on the circumference of a circle which rolls on the convex side of another fixed curve. The curve generated by rolling on the concave side is called a 'hypocycloid'. If the point is not on the circumference, the generated curves are called 'trochoids'.

**Epicycloidal Wheel**, a wheel or ring fixed to a framework, toothed on its inner side, and having in gear with it another toothed wheel of half the diameter of the first, tilted so as to revolve about the centre of the latter. It is used for converting circular into alternate motion, or alternate into circular. While the revolution



Epicycloidal Wheel

of the smaller wheel is taking place, any point whatever on its circumference will describe a straight line, or will pass and re-pass through a diameter of the circle, once during each revolution. In practice, a piston-rod or other reciprocating part may be attached to any point on the circumference of the smaller wheel.

**Epidaur'us**, a town and seaport of ancient Greece, situated in Argolis, in the Peloponnesus, particularly celebrated for its magnificent temple of *Æsculapius*, which stood on an eminence not far from the town. It had also temples of Artemis, Dionysus, Aphrodite, and Hera, and a splendid theatre still in fair preservation. The site is now occupied by the village *Epidauvo*, where a congress met in 1822 and promulgated the 'Constitution of Epidaurus'.

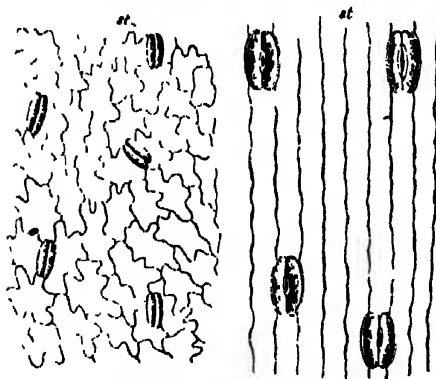
**Epidem'ic**, or **Epidemic Disease** (Gr. *epi*, upon, and *dēmos*, people), signifies a disease which attacks a people, suddenly spreading from one to the other in all directions, prevailing a certain time and then dying away. It usually travels from place to place in the direction of the most-frequented lines of communication. The reason is that such diseases are commonly, due to some infective material capable of being

conveyed from one individual to another, and of being transported from place to place. In Britain smallpox and cholera are occasionally epidemic, whilst scarlet fever, measles, chickenpox, diphtheria, typhoid fever, &c., are almost invariably so. Certain diseases which appear to be more mental than physical sometimes occur so numerously as to assume an epidemic form, such as St. Vitus's dance, convulsionary diseases, or suicidal mania.

**Epiden'drum** (Gr. *epi*, upon, and *dendron*, a tree), a large genus of tropical American orchids, most of the species of which are epiphytic, growing on trees. The flowers are very handsome, and a large number of the species are in cultivation.

**Epider'mis**, in anatomy, the cuticle or scarf-skin of the body; a thin membrane covering the true skin of animals, consisting of two layers, an inner or mucous layer, called the *rete mucosum*, composed of active cells containing granules of colouring matter, and an outer or horny layer, consisting of flattened scale-like cells, dry, inactive, and effete, which are constantly being shed in the form of dust. Both layers are destitute of blood-vessels or nerves.

**Epidermis**, in botany, the superficial layer of cells covering leaves and young stems. Its



Surface View of Epidermis

st, Stomata

principal function is to restrict transpiration, for which purpose its outer wall is more or less cutinized, i.e. chemically modified so as to be very impervious to water and gases, especially the outermost part thereof, the so-called *cuticle*. Naturally both cuticle and epidermis as a whole are most strongly developed in drought-adapted plants or xerophytes (q.v.); and conversely the epidermis of submerged plants is not cutinized, nor is the superficial layer of ordinary roots. The epidermis frequently bears hairs of various kinds. Stems which undergo secondary growth

in thickness soon cast off their epidermis, its rôle being assumed by cork or bark. The water- and gas-proof covering provided by the epidermis is not continuous, but is interrupted by numerous minute pores or *stomata*, capable of opening and closing, through which accordingly a regulated interchange of gases takes place.

**Ep'idote**, a mineral of a green or grey colour, vitreous lustre, and partial transparency, a member of the garnet family. The primary form of the crystals is a right rhomboidal prism. The crystals occur in Norway, Siberia, Tyrol, and the United States.

**Epigæa** (-jé'a), a genus of Ericaceous shrubs. *E. repens*, the trailing arbutus, is the May-flower of North America.

**Epiglottis** is a cartilaginous plate behind the tongue, which covers the glottis like a lid during the act of swallowing, and thus prevents foreign bodies from entering the larynx. In its ordinary position during respiration it is pointed upwards, but in the act of swallowing it is pressed downwards and backwards by the drawing up of the windpipe beneath the base of the tongue, and thus closes the entrance to the air-passages. See *Larynx*.

**Ep'igram** (Gr. *epi*, upon, *graphein*, to write), in a restricted sense, a short poem or piece in verse, which has only one subject, and finishes by a witty or ingenious turn of thought; in a general sense, a pointed or witty and antithetical saying. The term was originally given by the Greeks to a poetical inscription placed upon a tomb or public monument, and was afterwards extended to every little piece of verse expressing with precision a delicate or ingenious thought, as the pieces in the *Greek Anthology*. In Roman classical poetry the term was somewhat indiscriminately used, but the epigrams of Martial contain a great number with the modern epigrammatic character. Epigrams flourished in modern times after the Revival of Learning period, and all the Elizabethan versifiers tried their hand at them. Pope was a great master of the epigram, and the art was practised by Clément Marot, Boileau, Voltaire, Schiller, Goethe, Byron, and Moore, and more recently by Sir William Watson.—Cf. Dodd, *Epigrammatists of Mediæval and Modern Times*.

**Epigraphy**, a term used both for the study of inscriptions as a whole, and for the science which deals with their classification and decipherment. The attention of the epigraphist is given to inscriptions upon stone, brick, metal, and other comparatively permanent material, as compared with writings upon parchment, papyrus, or paper; but he excludes inscriptions upon coins, which are in the department of the numismatist. The science of epigraphy is of immense importance for a knowledge of the past, the subject

including inscriptions so far apart in point of time as Egyptian records of the days of Mena (4700 B.C.), and the Greek hexameters that commemorate the death in Westmorland of a young Syrian soldier in the army of Septimius Severus. Of still more recent date are the Runic inscriptions discovered in Greenland, which seem to place beyond a doubt the fact of Icelandic explorers having reached that country in the eleventh or twelfth century. The most important inscriptions are Egyptian, Cuneiform (Babylonian and Assyrian), Semitic, Greek, Latin, Indian, and Runic. The inscribed writings include epitaphs on the dead, records of important events, dedications of public buildings, with such comparatively private matters as receipts, contracts, and other business transactions. While inscriptions form a valuable source of knowledge, they cannot be accepted as invariably reliable. Reasons might in some cases exist for making a false or misleading record, as in the case of a eulogistic tombstone, while mistakes in spelling and other details may be due to a careless workman. The literature which deals with the science of epigraphy is very large.

**Epigynous** (e-pij'i-nus) Flowers, those in which the gynæcium is inferior, i.e. embedded in, and adherent to, the hollowed-out receptacle, so that the other parts of the flower appear to be inserted on the top of the ovary.

**Epilepsy** (Gr. *epilepsia*, literally, a seizure), a nervous disease, the falling-sickness, so called because the patient falls suddenly to the ground. It depends on various causes, often exceedingly complicated and incapable of being removed; hence it is often an incurable periodical disease, appearing in single paroxysms. In its fully developed form, convulsions, attended by complete unconsciousness, are the prominent feature. Among the different causes may be mentioned intense emotional disturbance in early childhood, injury to the brain or its coverings at birth or subsequently, or some irritation within the skull itself, such as tumours, &c., developing later in life. Epileptiform fits due to the last-mentioned cause differ from those of true epilepsy, and are known as *Jacksonian epilepsy* (cf. Sir W. K. Gowers, *The Borderland of Epilepsy*). It is, for the most part, preceded by a tingling sensation, creeping up from the foot or hand to the breast and head, or some other premonitory symptom such as spectral illusions, headache, giddiness, confusion of thought, sense of fear, &c.; but

sometimes there are no precursive symptoms. During the paroxysm all that is to be attended to is to prevent the patient from injuring himself; and this is to be accomplished by raising the head gently and loosening all tight parts of the dress. It is advisable to protect the tongue from being bitten by introducing a piece of india-rubber, cork, or soft wood between the teeth.

**Epilobium**, the willow-herb, a genus of plants, nat. ord. Onagraceæ. The species are herbs or under-shrubs with pink or purple, rarely yellow, flowers, solitary in the axils of the leaves or in terminal leafy spikes. The seeds are tipped with a pencil of silky hairs, and are contained in a long four-celled capsule. There are more than fifty species scattered over the arctic and temperate regions of the world, ten of them being natives of Britain.

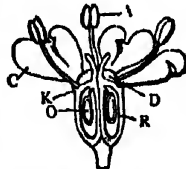
**Epimenides** (-îdéz), an ancient Greek philosopher and poet, born in Crete in the seventh century before Christ. He was held for an infallible prophet, and by some is reckoned among the seven wise men, instead of Periander. He is supposed to be the prophet referred to by St. Paul in *Titus*, i, 12: "One of themselves, even a prophet of their own, said, The Cretians are always liars, evil beasts, slow bellies".

**Epimetheus** (ep-i-mê'thûs), in Greek mythology, the son of Iapetus, brother of Prometheus, and husband of Pandora. Epimetheus may be translated 'afterthought', as Prometheus 'forethought'.

**Épinal**, a town of Eastern France, capital of the department of the Vosges, on the Moselle. It is well built and has handsome quays, an ancient Gothic church, a communal college, a public library of 30,000 volumes, a museum, and extensive fortifications. The town was occupied by the Germans in the Franco-Prussian War of 1870, and since that time a modern fortress has been constructed. The manufactures consist of articles in metal, cottons, linens, woollens, earthenware, and leather. The famous paper-mills of Archettes are in the vicinity. Pop. 30,000.

**Épinay**, Louise Florence Pétronille, Madame d', French authoress, born in 1726, died 1783. She became the wife of M. Delalive d'Épinay, who was collector-general of taxes. In 1748 she became acquainted with Rousseau, and gave him a cottage in which he passed many of his days. She was the author of *Les Conversations d'Émilie*, a companion-volume to Rousseau's *Émilie*; *Lettres à mon Fils*; and *Mes Moments heureux*. She left interesting memoirs and correspondence.

**Epiphanius**, St., was born in Palestine about 310, died 403. About 307 he was consecrated Bishop of Salamis or Constantia, in Cyprus. A



Vertical Section of an Epigynous Flower

R, Receptacle K, Calyx.  
C, Corolla A, Androecium  
D, Disc. O, Ovule.



zealous denouncer of heresy, he combated the opinions of Arius and Origen. His work *Panarion* gives the history, together with the refutation, of a great number of heresies. His festival is on the 12th of May.

**Epiph'any** (Gr. *epiphaneia*, a manifestation or showing forth), a festival, otherwise called the *manifestation of Christ to the Gentiles*, observed on the 6th of January in honour of the adoration of our Saviour by the three Magi, or wise men, who came to adore him and bring him presents, led by the star. As a separate festival it dates from 813.

**Ep'iphyte** (Gr. *epi*, on, *phyton*, a plant), a plant which grows and flourishes on the trunks and branches of trees, adhering to the bark, as a moss, lichen, fern, &c., but which does not, like a parasite, derive any nourishment from the plant on which it grows. Most orchids are epiphytes, and so are many Bromeliaceæ and Cactaceæ. Epiphytic Angiosperms are characteristic of humid tropical regions. Depending as they do entirely on atmospheric moisture, they show many curious adaptations, and are nearly always more or less xerophytic in structure.

**Ep'irus** (Gr. *Epeiros*), a country of ancient Greece corresponding to Southern Albania and the north-western division of modern Greece. The most interesting locality in it was Dodona. The inhabitants were only in part Greeks. The Molossians at last acquired the ascendancy, and the kings of this tribe took the name of kings of Epirus. The most celebrated King of Epirus was Pyrrhus, who made war upon the Romans. Epirus became a Roman province in 168 B.C., and shared the fortunes of Rome till it was conquered by the Turks. The population is about 250,000. In Nov., 1914, Greece, with the consent of the Great Powers, occupied North Epirus, and formally took possession of it in March, 1916. By the end of 1920, however, the occupation had not yet been recognized.—Epirus is also the name of an administrative province of Greece, formed after the Balkan campaigns (1912-3) out of the territory acquired by the country.

**Epistemology** (Gr. *epistēmē*, knowledge), that department of metaphysics which investigates and explains the doctrine or theory of knowing. It deals with the validity of knowledge rather than with the analysis of the knowing mind, and is thus distinguished from *psychology*. It is also distinguished from *ontology*, which investigates real existence or the theory of being.

**Epistolæ Obscuro'rum Viro'rum** (*Letters of Obscure Men*), the title of a collection of satirical letters which appeared in Germany in 1515, and professed to be the composition of certain ecclesiastics and professors in Cologne and other places. It is considered as one of the most

masterly pieces of sarcasm in the history of literature, and its importance is enhanced by the effect it had in promoting the cause of the Reformation. The authorship of this satire has been a fertile subject of controversy, and is yet apparently far from being settled. It was ascribed to Reuchlin, and afterwards to Reuchlin, Erasmus, and Hutten. By a Papal bull the work was placed on the Index of forbidden books.

**Ep'itaph** (Gr. *epi*, upon, and *tapos*, tomb), an inscription upon a tomb or monument in honour or memory of the dead. Epitaphs were in use both among the Greeks and Romans. The Greeks distinguished by epitaphs only their illustrious men. Among the Romans they became a family institution, and private names were regularly recorded upon tombstones. The same practice has generally prevailed in Christian countries. On Christian tombstones epitaphs usually give brief facts of the deceased's life, sometimes also the pious hopes of survivors in reference to the resurrection or other doctrines of the Christian faith, &c. Many so-called epitaphs are mere witty *jeux d'esprit*, which might be described as epigrams, and which were never intended seriously for monumental inscriptions. Dr. Johnson and William Wordsworth wrote essays on epitaphs.—Cf. Andrews, *Curious Epitaphs*.

**Epithalamium** (Gr. *epi*, on, and *thalamos*, a chamber), a nuptial song or poem in praise of a bride and bridegroom. Among the Greeks and Romans it was sung by young men and maids at the door of the bridal chamber of a newly-married couple. Epithalamia have been written by Spenser, Ben Jonson, and Donne.

**Epithelium**, in anatomy, the cellular layer which lines the internal cavities and canals of the body, both closed and open, as the mouth, nose, respiratory organs, blood-vessels, &c., and which is analogous to the cuticle of the outer surface. There are several varieties of epithelium. The epithelium lining the blood-vessels is called sometimes *endothelium*.

**Epizo'a**, a term applied to those parasitic animals which live upon the bodies of other animals, as lice, the itch-mite, &c.

**Epizoot'ic**, or **Epizootic Disease**, a disease that at some particular time and place attacks great numbers of the lower animals just as an epidemic attacks man. Pleuro-pneumonia is often an epizootic, as is also the rinderpest.

**Epoch**, or **Era**, is a fixed point of time, commonly selected on account of some remarkable event by which it has been distinguished, and which is made the beginning or determining point of a particular year from which all other years, whether preceding or ensuing, are computed. The creation and the birth of Christ

are the most important of the historical epochs. The creation has formed the foundation of various chronologies, the chief of which are: (1) The epoch adopted by Bossuet, Ussher, and other Catholic and Protestant divines, which places the creation in 4004 B.C. (2) The *Era of Constantinople* (adopted by Russia), which places it in 5508 B.C. (3) The *Era of Antioch*, used till A.D. 284, placed the creation 5502 B.C. (4) The *Era of Alexandria*, which made the creation 5492 B.C. This is also the *Abyssinian Era*. (5) The *Jewish Era*, which places the creation in 3760 B.C. The Greeks computed their time by periods of four years, called *Olympiads*, from the occurrence every fourth year of the Olympic games. The first Olympiad, being the year in which Corcebus was victor in the Olympic games, was in the year 776 B.C. The Romans dated from the supposed era of the foundation of their city (Ab Urbe Condita, A.U.C.), the 21st of April, in the third year of the sixth Olympiad, or 753 B.C. (according to some authorities, 752 B.C.). The *Christian Era*, or mode of computing from the birth of Christ as a starting-point, was first introduced in the sixth century, and was generally adopted by the year 1000. This event is believed to have taken place earlier, perhaps by four years, than the received date. The Julian epoch, based on the coincidence of the solar, lunar, and indictional periods, is fixed at 4713 B.C., and is the only epoch established on an astronomical basis. The *Mohammedan Era*, or *Hijra*, commences on 16th July, 622, and the years are computed by lunar months. The Chinese reckon their time by cycles of 60 years. Instead of numbering them as we do, they give a different name to every year in the cycle.

**Epping**, a village of England, in Essex (giving name to a parliamentary division), 17 miles from London, in the midst of an ancient royal forest which one time covered nearly the whole of Essex. The unenclosed portion (5000 acres) was bought by the Corporation of London in 1882, and secured to the public as a free place of recreation. Pop. 4253.

**Epsom**, a town in the county of Surrey, England, 15 miles S.W. of London, formerly celebrated for a mineral spring, from the water of which the well-known Epsom salts were manufactured. The principal attraction Epsom can now boast of is the grand race-meeting held on the Downs, the chief races being the Derby and Oaks. Epsom gives name to one of the seven parliamentary divisions of the county. Pop. 19,156.

**Epsom Salts**, sulphate of magnesium ( $MgSO_4 \cdot 7H_2O$ ), a cathartic salt which appears in capillary fibres or acicular crystals. It is found covering crevices of rocks, in mineral springs, &c.; but is commonly prepared by artificial processes

from magnesian limestone by treating it with sulphuric acid, or by dissolving the mineral *kieserite* ( $MgSO_4 \cdot H_2O$ ) in boiling water, allowing the insoluble matter to settle, and crystallizing out the Epsom salts from the clear solution. It is employed in medicine as a purgative, and in the arts. The name is derived from its having been first procured from the mineral waters at Epsom.

**Epworth**, a small town of N. Lincolnshire, 9 miles N. of Gainsborough, the birth-place of John Wesley, the founder of Methodism. Pop. 1836.

**Equation**, in algebra, a statement that two expressions have the same numerical value. An equation may be either identical or conditional. An example of an *identical equation*, or *identity*, is  $(x + y)(x - y) = x^2 - y^2$ . The left side here can be transformed into the right side, simply by applying the laws of algebra so as to carry out the operations indicated, without taking account in any way of the numerical values of  $x$  and  $y$ . An identical equation is, therefore, true for all values of the variables which appear in it. A *conditional equation* is not true unless certain special values are assigned to the variables. Thus the equation  $4x + 7 = 15$  is not true for any value of  $x$  except 2. This value 2 is called a *root*, or *solution*, of the equation. An equation may have more than one root, e.g.  $x^2 + 6x = 7$  has two roots, 1 and  $-7$ ; and  $2x^3 + 3x^2 = 2x + 3$  has three roots, 1,  $-1$ ,  $-\frac{3}{2}$ .

**Rational Integral Equations (one Variable).**—The three equations just given are special cases of the class of rational integral algebraic equations. The general form of these is  $ax^n + bx^{n-1} + \dots + kx + l = 0$ , where  $n$  is a positive integer, and  $a, b, \dots, k, l$  are given numbers. This equation is said to be of degree  $n$ . The branch of mathematics called the Theory of Equations is conventionally restricted to equations of this type. The fundamental result in this subject is that every rational integral equation has a root, a theorem which it is by no means easy to prove. It follows without difficulty that an equation of degree  $n$  has exactly  $n$  roots, real or imaginary. Two or more of the roots, however, may be equal to each other. To *solve* an equation is to find its roots. The general equation of degree  $n$  can always be solved to any degree of approximation desired, when the numerical values of the coefficients  $a, b, \dots$  are assigned. Graphical methods of solution are often the best (see *Graph*). When the coefficients  $a, b, \dots$  are arbitrary, the general equation can be solved algebraically if  $n$  does not exceed 4, but not for greater values of  $n$ . It is not that the algebraical solution, or algebraic formula for the roots, when  $n$  is greater than 4, has not been discovered; it does not exist. This was proved more than

a hundred years ago by Abel and Galois, two mathematicians of the highest distinction, who both died before they were thirty. For  $n = 2$ , the roots of the *quadratic* equation  $ax^2 + bx$

$+ c = 0$  are  $\frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$ . For  $n = 3$ ,

the *cubic* equation  $ax^3 + bx^2 + cx + d = 0$  is reduced to the form  $z^3 + pz + q = 0$  by putting  $x = z - \frac{b}{3a}$ ; the solution of  $z^3 + pz + q = 0$  can be verified to be  $z = u - \frac{p}{3u}$ , where  $u$  is

any one of the three cube roots of the quantity  $-\frac{1}{2}q + \sqrt{\frac{1}{4}q^2 + \frac{1}{27}p^3}$ . For  $n = 4$ , the *biquadratic* equation is solved with the help of the solution of the cubic. The cubic was first solved by the Italian mathematician Tartaglia, who communicated the solution to Cardan, after binding him to keep it a secret. Cardan, however, gave the solution in his *Algebra*, published at Nurnberg in 1545.

*Equations with more than one Variable.*—A solution of an equation which contains more than one variable is a set of values of the variables making the equation true. Thus the equation  $x^2 - y^2 = 9$  has solutions ( $x = 5, y = 4$ ), ( $x = 3, y = 0$ ), ( $x = 5, y = -4$ ), and an unlimited number of others. When several variables occur, there are usually also several *simultaneous* equations connecting them; a solution of these is a set of values of the variables making *all* the equations true. When the number of equations is equal to the number of variables, there is in general a limited number of solutions of the system. Thus, e.g. the system of equations  $x^2 - y^2 = 0, 2x - y = 6$  has two solutions ( $x = 3, y = 0$ ) and ( $x = 5, y = 4$ ), and no others. A useful rule is that the number of solutions of a system of this type is equal to the product of the degrees of the equations. Exceptions may arise when two solutions coalesce, or when infinite values of the variables occur.

Equations are of great importance in applied mathematics. The data of a problem generally lead to an equation, or a set of equations, among the quantities concerned. In practice a certain number of these quantities are known in any given case; the unknown quantities are then found by the solution of an equation or equations. Non-algebraic equations occur frequently—equations involving trigonometrical functions, for example. For a modern practical method of solving equations of many types, see *Nomography*. —BIBLIOGRAPHY: A. E. Layng, *Elementary Algebra*; C. Smith, *Algebra*. More advanced works are: G. Chrystal, *Algebra*; W. S. Burnside and A. W. Panton, *Theory of Equations*.

—*Equation, Personal*, the accustomed error, almost a constant quantity in the case of a

practised observer, in timing a celestial phenomenon.

*Equation of Payments*, an arithmetical rule for the purpose of ascertaining at what time it is equitable that a person should make payment of a whole debt which is due in different parts, payable at different times.

*Equation of the Centre*, the difference between the actual heliocentric longitude of a planet revolving in an elliptic orbit and that which it would have at the same instant if it revolved in a circular orbit. It is zero at perihelion and aphelion.

*Equation of Time*, the difference between mean and apparent time, or the difference of time as given by a clock and as given by a sundial, arising chiefly from the varying velocity of the earth in its orbit and the eccentricity of the orbit. The sun and the clock agree four times in the year; the greatest difference between them at the beginning of November is fully sixteen minutes. See *Day*.

*Equator*, that great circle of our globe every point of which is  $90^\circ$  from the poles. All places which are on it have invariably equal days and nights. Our earth is divided by it into the northern and southern hemispheres. From this circle is reckoned the latitude of places both north and south. There is also a corresponding celestial equator in the plane of the terrestrial, an imaginary great circle in the heavens the plane of which is perpendicular to the axis of the earth. It is everywhere  $90^\circ$  distant from the celestial poles, which coincide with the extremities of the earth's axis, supposed to be produced to meet the heavens. During his apparent yearly course the sun is twice in the celestial, that is, vertically over the terrestrial equator, on 21st March and 23rd September. Then the day and night are equal all over the earth, whence the name *equinox*.—The *magnetic equator* is a line at every point of which the vertical component of the earth's magnetic force is zero; that is to say, a dipping needle carried along the magnetic equator remains horizontal. It is hence also called the *acclinic line*. It has a slightly devious course, but upon the whole keeps fairly near the geographical equator.

*Equatorial*, an astronomical instrument contrived for the purpose of directing a telescope upon any celestial object, and of keeping the object in view for any length of time, notwithstanding the diurnal motion of the earth. For these purposes a principal axis resting on firm supports is mounted exactly parallel to the axis of the earth's rotation, and consequently pointing to the poles of the heavens, being fixed so as to turn on pivots at its extremities. To this there is attached a telescope moving on an axis of its own in such a way that it may either be exactly

parallel to the other axis, or at any angle to it; when at right angles it points to the celestial equator. The two axes carry graduated circles, with the help of which, even during the day, the telescope can be pointed to any star whose declination and right ascension are known. By means of clockwork the instrument is given such a motion round its principal axis that the star is kept stationary in the field of view.

**Eq'erry**, in Britain, the name of certain officers of the royal household, in the department of the Master of the Horse, whose duties consist in attendance when the sovereign rides abroad. Equerries also form part of the establishments of the members of the royal family.

**Equestrian Order**, the order of 'Knights' in ancient Rome. The *equites* or knights originally formed the cavalry of the army. They are said by Livy to have been instituted by Romulus, who selected 300 of them from the three principal tribes. About the time of the Gracchi (123 B.C.) the *equites* became a distinct order in the state, and the judges and the farmers of the revenue were selected from their ranks. They held their position in virtue of a certain property qualification, and towards the end of the Republic they possessed much influence in the state. They had particular seats assigned to them in the circus and theatre, and the insignia of their rank, in addition to a horse, were a gold ring and a robe with a narrow purple border (the *clavus angustus*). Under the later emperors the order grew less influential, and finally disappeared.

**Eq'uidae**, the horse family, a division of the odd-toed (perissodactyle) Ungulates or hoofed mammals. There is but one existing genus, *Equus*, distinguished by the possession of a mane; hard pads (callosities) on the inner side of each fore-limb (and sometimes of the hind-limb); a single functional digit (the third or middle one) terminating in a large curved hoof; a simple stomach; 44 teeth, including 12 incisors with pitted crowns, 4 canines (tushes) reduced in the female, and 28 grinding teeth with broad crowns, except the first (wolf tooth), which is rudimentary. The forms included are horses, asses, and zebras; the first being distinguished from the others by the presence of callosities ('chestnuts') on the hind-limbs as well as the fore. The domesticated horse (*E. caballus*) has a large flat tail abundantly hair-clad, and is not known with certainty in the wild state, though possibly the tarpan of South Russia (Tartary) may represent the original stock. Another candidate for this honour is the small wild species (*E. przewalskii*) native to the deserts of Central Asia. The domestic ass (*E. asinus*) is related to a number of wild species, such as the onager (*E. onager*) of South Asia, the kiang (*E. he-*

*monus*) of Tibet, and two African species (*E. africanus* and *E. somalicus*). The striped zebras are purely African, and four species are generally recognized—the common or mountain zebra (*E. zebra*), Burchell's zebra (*E. burchelli*), Grevy's zebra (*E. grevyi*), and the quagga (*E. quagga*). The geological record enables us to derive horses from a small plantigrade five-toed form (*Phenacodus*), by gradual increase in size, complication of teeth, loss of digits, and elongation of limbs, to the unguligrade condition.

**Equilib'rium**, in statics, the condition when a body is acted on by two or more forces which balance one another. The body may be either at rest or moving with uniform speed in a straight line. In the first case, when the body, being slightly moved out of any position, always tends to return to its position, that position is said to be one of *stable equilibrium*; when the body, after a slight displacement, tends to move away from its previous position, the body is in *unstable equilibrium*. If, after displacement, the body tends to remain at rest, its state is one of *neutral equilibrium*.

**Equinoct'ial**, in astronomy, the circle in the heavens otherwise known as the celestial equator. When the sun is on the equator, there is equal length of day and night over all the earth: hence the name *equinoctial*.—*Equinoctial gale*, storms which have been supposed to take place about the time of the sun's crossing the equator, that is, at the vernal and autumnal equinoxes, in March and September.—*Equinoctial points* are the two points wherein the celestial equator and ecliptic intersect each other; the one, the first point of Aries, is called the *vernal point*; and the other, in Libra, the *autumnal point*. These points move backward or westward at the rate of 50" of arc in a year. This is called the *precession of the equinoxes*.

**Equinox**, one of the equinoctial points. The term is also applied to the dates at which the sun passes through them, viz. 21st March and 23rd September, when day and night are of equal length all over the world. See *Day*; *Earth*; *Equinoctial*; *Seasons*.

**Equisetales**, a group of Pteridophytes, represented at the present day only by the genus *Equisetum* (q.v.). It was much more prominent in the Carboniferous flora, in which large woody horse-tails (*Calamites*) played an important part.

**Equisetum**, a genus of vascular cryptogamous plants with hollow jointed stems, type of the group Equisetales, growing in wet places, and popularly called *horse-tails*.

**Eq'uity** (Lat. *aequus*, fair, equal), in English law, the system of supplemental law administered in certain courts, founded upon defined rules, recorded precedents, and established principles, the judges, however, liberally expounding

and developing them to meet new exigencies. While it aims at assisting the defects of the common law, by extending relief to those rights of property which the strict law does not recognize, and by giving more ample and distributive redress than the ordinary tribunals afford, equity by no means either controls, mitigates, or supercedes the common law, but rather guides itself by its analogies, and does not assume any power to subvert its doctrines. The Court of Chancery was formerly in England the especial court of equity, but large powers were by the Judicature Act of 1873 given to all the divisions of the Supreme Court to administer equity, although many matters of equitable jurisdiction are still left to the chancery division in the first instance. —BIBLIOGRAPHY: F. T. White and O. O. Tudor, *Lending Cases in Equity*; C. Thwaites, *Student's Guide to Equity*.

**Equity of Redemption**, in law, the advantage allowed to a mortgager of a reasonable time to redeem an estate mortgaged, when it is of greater value than the sum for which it is mortgaged.

**Equivalent**, in chemistry, the number of parts by weight of an element which will combine with or displace 8 parts by weight of oxygen or 100 parts by weight of hydrogen.

**Eranthis**. See *Winter Aconite*.

**Erard, Sébastien**, a celebrated musical-instrument maker, born at Strasbourg in 1752, died 1831. He went to Paris at the age of eighteen, and in concert with his brother, Jean Baptiste, produced pianofortes superior to any that had previously been made in France. He afterwards established a manufactory in London, and made considerable improvements in the mechanism of the harp.

**Erastistratus**, an ancient Greek physician and anatomist, said to have been a grandson of Aristotle. He lived in the third century before the Christian era, and was court physician of Seleucus Nicator, King of Syria. He was the first who systematically dissected the human body, and his description of the brain and nerves is much more exact than any given by his predecessors. He classified the nerves into nerves of sensation and of locomotion, and, it is said, almost stumbled upon the discovery of the circulation of the blood. Of his works only the titles and some fragments remain.

**Erasmus, Desiderius**, a Dutch scholar, one of the greatest of the Renaissance and Reformation period, born at Rotterdam in 1467, died in 1536. His original name was Gerard, but this he changed according to a fashion of the time. After the death of his parents, whom he lost in his fourteenth year, his guardians compelled him to enter a monastery; and at the age of seventeen he assumed the monastic habit. The Bishop

of Cambrai delivered him from this constraint. In 1492 he travelled to Paris to perfect himself in theology and literature. He became the instructor of several rich Englishmen (from one of whom—Lord Mountjoy—he received a pension for life), and accompanied them to England in 1497, where he was graciously received by the king. Returning soon after to the Continent, he took his doctor's degree, was relieved from his monastic vows by dispensation from the Pope, and published several of his works. In 1510 he returned to England, wrote his *Praise of Folly* while residing with Sir Thomas More, and was appointed Lady Margaret professor of divinity and Greek lecturer at Cambridge. In 1514 he returned to the Continent and lived chiefly at Basel, where he died. To extensive learning Erasmus joined a refined taste and a delicate wit, and rendered great and lasting service to the cause of reviving scholarship. Although Erasmus took no direct part in the Reformation, and was reproached by Luther for lukewarmness, he attacked the disorders of monasticism and superstition, and everywhere promoted the cause of truth. A humanist rather than a reformer or a theologian, he waged war upon ignorance and superstition. He edited various classics, the first edition of the Greek Testament from MSS. (with Latin translation), &c., but his best-known books are the *Encomium Morie* (Praise of Folly) and his *Colloquies*. His letters are very valuable in reference to the history of that period. —BIBLIOGRAPHY: S. Knight, *Life of Erasmus*; C. Butler, *Life of Erasmus*; E. F. H. Cupey, *Life of Erasmus*; P. S. Allen, *The Age of Erasmus*.

**Erastus** (Gr. *erastos*, beloved, translation of Ger. *Lieber*), the learned name of Thomas Lieber, a Swiss physician, who maintained the opinions from which the well-known epithet of *Erastian*, as now used, is derived. He was born at Baden in 1523, and died at Basel 1584. He was successively professor of medicine at Heidelberg, and of ethics at Basel. In his writings he maintained the complete subordination of the ecclesiastical to the secular power; and denied to the Church the right to exclude any one from Church ordinances, or to inflict excommunication.

**Erato**, in Greek mythology, one of the nine Muses, whose name signifies loving or lovely. She presided over lyric and especially amatory poetry, and is generally represented crowned with roses and myrtle, and with the lyre in the left hand and the plectrum in the right in the act of playing.

**Eratosthenes**, an ancient Greek astronomer, born at Cyrene, in Africa, 276 B.C., died about 194 B.C. He was librarian at Alexandria, and gained his greatest renown by his investigations of the size of the earth. He rendered much service to the science of astronomy, and first

observed the obliquity of the ecliptic. Of the writings attributed to him one only remains complete—*Kalasterismoi*—which treats of the constellations.

Er'blum, a rare metal found along with yttrium, terbium, and other rare elements in some rare minerals. Its properties are but little known. It was discovered by Mosander in 1843.

Ercilla y Zúñiga (er-thil'yá ē thio-nyē'gá), Don Alonso de, Spanish soldier and poet, born 1583, died 1595. He became page to the Infant Don Philip, accompanied him on his travels, and in 1554 went with him to England, on the occasion of his marriage with Queen Mary. After this he fought against the Araucanians of South America (Chile), and his epic *La Araucana* is based on the events of this war. It is written in excellent Spanish, and occupies an honourable position in the national literature. The first fifteen cantos were published in 1569, and the continuations, thirty-seven cantos, appeared in 1578 and 1580.

Eckmann-Chatrlian (shat-ri-ān), the joint name of two French-Alsatian writers of fiction. Émile Eckmann, born at Pfalzburg 1822, studied law at Paris, and died in 1890. Alexandre Chatrlian, born near Pfalzburg in 1826, died in 1890, was for some time teacher in the Pfalzburg College. They formed a literary partnership in 1847, but it was not till the appearance of *L'Illustre Docteur Mathéus* in 1859 that success attended them. Among their most popular books are: *L'Ami Fritz*, *Madame Thérèse*, *Histoire d'un Conscrié de 1813*, *L'Histoire d'un Paysan*, and *Waterloo*, most of which have been translated into English. Their drama *Le Juif Polonais* was made famous by Sir Henry Irving under the name of *The Bella*.

Erdmann, Johann Eduard, German philosopher, born 1805, died 1892. He studied theology at Dorpat and Berlin; in 1820 became a clergyman, but in 1832 returned to Berlin and took his degree in philosophy. In 1830 he became professor extraordinary of philosophy at Halle, being appointed ordinary professor in 1830. He wrote numerous philosophical works, mostly characterized by Hegelian tendencies, including: *Body and Soul*, *Nature and Creation*, *Outlines of Psychology*, *Outlines of Logic and Metaphysics*, *Psychological Letters*, and *Belief and Knowledge*. His greatest work is his *Outlines of the History of Philosophy*, which has been translated into English (3 vols., 1889).

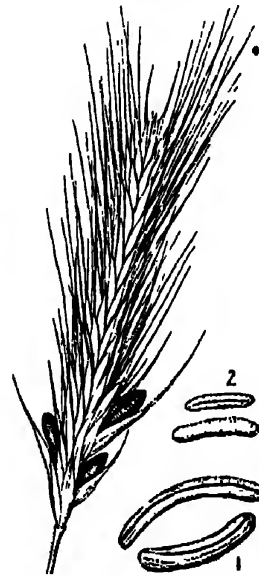
Er'ebus, in Greek mythology, the son of Chaos and Darkness, and father of Æther and Hæmera (day). The name Erebus was also given to the infernal regions.

Er'ebus, Mount, a volcano of the antarctic regions in S. Victoria Land; height, 12,400 feet; discovered by Ross, 1841.

Erechtheus (e-rek'thūs), in Greek mythology, a mythical king of Athens to whom a fine temple, the *Erechthæum*, was built on the Acropolis. In some representations of him he is depicted as half snake, so that he was one of the autochthonæ, the earth-born ancestors of the Athenians.

Erection, Lords of, in Scots history, those private owners into whose hands the ecclesiastical estates belonging to the clergy had passed during the religious changes of the Reformation period.

Er'furt (Lat. *Erfordia*, ford of Erpe, its legendary founder), an important town in the Prussian province of Saxony, on the River Gera, formerly a fortress with two citadels, now given up as such. It has a fine cathedral dating from the thirteenth century and several handsome Gothic churches. The university, founded in 1378 and suppressed in 1816, was long an important institution. There is still an academy of science and a library with 60,000 volumes. The monastery (now an orphanage) was the residence of



Ergot of Rye

1. Spanish ergot. 2. Russian ergot

Luther from 1501 to 1508. Erfurt is a busy industrial town and is in a very flourishing condition. The industries are varied, including clothing, machinery, leather, shoes, ironmongery, and chemicals. Flower-growing is extensively carried on in the neighbourhood, plants and seed being produced for sale in great quantities. Pop. 123,550.

Er'got, the altered grain of rye and other

grasses caused by the attack of an ascomycetous fungus called *Claviceps purpurea*. The grain is replaced by a dense fungoid tissue (sclerotium) largely charged with an oily fluid. In its perfect state this germinates and produces the *Claviceps* fructification. When diseased rye of this kind is eaten in food for some time, it sometimes causes death by a kind of mortification called dry gangrene. Ergot is used in obstetric practice to promote the contraction of the uterus.

*Erica* (e-rī'ka), the heaths, a large genus of branched rigid shrubs, type of the nat. ord. Ericaceæ, most of which are natives of South Africa, a few being found in Europe and Asia. The leaves are narrow and rigid; the flowers are globose or tubular, and four-lobed. Five species are found in Britain.

*Ericaceæ*, a nat. ord. of gamopetalous Dicotyledons. Representative genera: *Calluna*, *Erica*, *Rhododendron*.

*Erichsen* (er'ik-sen), Sir John Eric, surgeon, born 1818, died in 1896. He was the son of a Copenhagen merchant, but spent nearly all his life in England. He studied at University College, London, became a member of the Royal College of Surgeons in 1839, a fellow in 1845, and in 1850 professor of surgery and hospital surgeon at University College. In 1865 he succeeded Quain as professor of clinical surgery in the same college, but retired in 1875. Appointed president of University College in 1887, he also held that post till his death. He was chief surgeon extraordinary to Queen Victoria, and in 1895 was made a baronet. His most important work was his *Science and Art of Surgery* (1853), which has gone through many editions, and has been translated into several languages. He also published a volume on *Concussion of the Spine* (1875).

*Ericsson*, John, engineer, born in Sweden 1803, died in 1889. He served for a time in the Swedish army; removed to London in 1826, and to New York in 1839. He is identified with numerous inventions and improvements in steam machinery and its applications. His chief inventions are his calorific engine, the screw propeller (1836), which has revolutionized navigation, and his turret-ships, the first of which, the *Monitor*, distinguished itself in the American Civil War, and inaugurated a new era in naval warfare. He afterwards devoted himself to studies of the earth's motion and the intensity of solar heat.

*Eridanus*, the River Eridanus (modern Po), one of the constellations of the ancient astronomy, in which Ptolemy catalogued thirty-four stars. Appropriately to its name, it covers a large expanse of the heavens, its northern portion, just to south-west of Orion, reaching the celestial equator. The part visible in our lati-

tudes does not contain bright stars, but at the southern extremity is the first-magnitude Acher-nar, a conspicuous object to southern observers.

*Erie* (ē'ri), one of the great chain of North American lakes, between Lakes Huron and Ontario, about 265 miles long, 63½ miles broad at its centre, from 40 to 60 fathoms deep at the deepest part; area, 6000 sq. miles. The whole of its southern shore is within the territory of the United States, and its northern within that of Canada. It receives the waters of the upper lakes by Detroit River at its south-western extremity, and discharges its waters into Lake Ontario by the Niagara River at its north-east end. The Welland Canal enables vessels to pass from it to Lake Ontario. It is shallow compared with the other lakes of the series, and is subject to violent storms. The principal harbours are those on the United States side—Buffalo, Erie, and Cleveland.

*Erie*, a city, Pennsylvania, United States, an important railway and commercial centre on the southern shore of Lake Erie. There are numerous ironworks (including foundries, rolling-mills, and blast-furnaces), petroleum refineries, breweries, tanneries, and wood-working factories. The harbour is one of the best on the lake. Pop. 76,000.

*Erie Canal*, the largest in the United States, serving to connect the great lakes with the sea. It begins at Buffalo on Lake Erie, and extends to the Hudson at Albany. It is 363 miles long; has in all 72 locks; a surface width 70 feet, bottom width 42 feet, and depth 7 feet. It is carried over several large streams on stone aqueducts; cost nearly £2,000,000, and was opened in 1825. The navigation is free.

*Erigena* (e-rif'e-na), Johannes Scotus (*Scotus*, Scot, and *Erigena*, Irish-born), an eminent mediæval scholar and metaphysician, probably born of Scotch parentage in Ireland about 800–810, died in France about 875. He spent a great part of his life at the court of Charles the Bald of France, and was placed at the head of the school of the palace. The king further imposed upon him the double task of translating into Latin the Greek works of the pseudo Dionysius the Areopagite, and of composing a treatise against Godeschule on *Predestination and Free-will*. This treatise, and another, *De Divisione Naturæ*, contained many views in opposition to the teachings of the Church. They were condemned by the Councils of Valencia in 855 and of Langres in 859, and Pope Nicholas I demanded the immediate disgrace of the culprit. His subsequent history is not known. — Cf. Gardner, *Studies in John the Scot*.

*Erinna*, a Greek poetess who lived about 600 B.C. She is said to have been an intimate friend of Sappho, and died at the age of eighteen.



She acquired a high reputation for poetry, and her chief work was called *Elakutē* (The Distaff), of which nothing has come down to us. An epitaph or two which are still extant, and believed by some to be hers, are by others deemed spurious.

*Erioden'dron*, the wool tree, a genus of plants, nat. ord. Malvaceæ (mallows). There are eight species natives of America, but one belongs to Asia and Africa. The species are noble plants, growing from 50 to 100 feet high, having palmate leaves, and red or white flowers. The woolly coat of the seeds of some of the species is used in different countries for stuffing cushions and similar purposes.

*Eris*, in Greek mythology, the goddess of discord, the sister of Ares, and, according to Hesiod, daughter of Nyx (night). Not being invited to the marriage of Peleus, she revenged herself by means of the apple of discord.

*Er'ith*, a town of England, in Kent, on the Thames, about 1½ miles east of London, a pleasant summer resort. Pop. 27,755.

*Eritre'a*, or *Erythræ'a* (from Gr. *erythros*, red, referring to the Red Sea), the official name of an Italian colonial possession stretching along the African shore of the Red Sea, and between it and Abyssinia, from the Egyptian coast territory to the French territory of Obok, at the Strait of Bab-el-Mandeb. The coast-line is about 670 miles in length, the area of the colony about 45,800 sq. miles. Pop., largely nomadic, about 450,000. The chief town is Massowah.

*Er'ivan*, a fortified city in Armenia, formerly the capital of a Russian government of the same name in Transcaucasia, on the Sanga, north of Mount Ararat. It has a citadel, barracks, a cannon foundry, and some manufactures. The Armenian Republic of Erivan was constituted in May, 1918. Pop. 34,000. The former Russian government of Erivan had an area of 10,725 sq. miles, and a pop. of 970,000.

*Erlang'en*, a town of Bavaria, 10 miles N.W. of Nürnberg. The Protestant university, founded in 1748, is the chief institution. The industries include cotton spinning and weaving, mirrors, hosiery, gloves, and combs. Pop. 24,874.

*Erlau*, or *Eger*, a town, Hungary, on the Eger, 65 miles E.N.E. of Budapest. It has sundry manufactures; and the red wines of the district, esteemed the best in Hungary, are largely exported. Pop. 28,050.

*Erl-king*, the English form of the name given in German and Scandinavian poetical mythology to a personified natural power which devises and works mischief, especially to children. Goethe's celebrated poem *Der Erlkönig* (literally 'elf-king') has rendered this malicious spirit universally known.

*Er'mine*, the stoat (*Putorius ermineus*), a

mammal of the weasel family widely distributed through the northern parts of both hemispheres, with a considerable range to the south. It is not generally known that the ermine and stoat are the same. In winter, in cold countries or severe seasons, the fur changes from a reddish-brown to a yellowish-white, or almost pure white, under which shade the animal is recognized as the ermine. In both states the tip of the tail is



Ermines (*Putorius ermineus*)

black. Its fur is short, soft, and silky, the best skins being brought from Russia, Sweden, and Norway. It is in great request, and was formerly one of the insignia of royalty, and is still used by judges. When used as linings of cloaks the black tuft from the tail is sewed to the skin at irregular distances. Stoats are among the enemies of the poultry-keeper, but by keeping down small rodents they benefit agriculture to a considerable extent. - In heraldry, ermine is one of the furs, represented with its peculiar spots black on a white ground.



Ermine

*Erne* (*ern*), the name often given to all the eagles of the genus *Haliaeetus*, but more specifically to the white-tailed sea-eagle.

*Erne*, Lough, a lake, Ireland, County Fermanagh, consisting of a north or lower, and a south or upper lake (with the town of Enniskillen between), connected by a narrow winding channel, and properly forming only expansions of the River Erne. Its entire length is about 40 miles; average breadth, 6 miles. It contains numerous small islands, and is well stocked with fish.—The River Erne rises in Lough Gowna, in the county of Longford, flows through Loughs Oughter and Erne, and falls into Donegal Bay below Ballyshannon. Length, 72 miles.

*Ernest Augustus*, King of Hanover and Duke of Cumberland, the fifth son of George III, born 1771, died 1851. In 1799 he was created Duke of Cumberland, in England, and became a field-marshal in the British army. On the death of William IV in 1837 he ascended the throne of

Hanover, in consequence of the succession to the sovereignty of that country being limited to males. He was succeeded by his son, George V. the last of the Hanoverian kings.

**Eros**, an asteroid discovered in Aug., 1898. It completes its orbit in 642 days, and has a mean distance from the sun of  $135\frac{1}{2}$  million miles, or 6 million less than that of Mars, and was the first to be discovered of the class of minor planets which come within the orbit of Mars. It can approach at times to  $13\frac{1}{2}$  million miles from the earth. It is supposed to have a diameter of 20 miles or less.

**Erosion Theory**, in geology, the theory, now held by all geologists, that valleys are, in the great majority of cases, due to the wearing influences of subaerial agents, such as rivers and glaciers, as opposed to the theory which regards them as the result of fissures in the earth's crusts produced by strains during its upheaval.

**Erotic** (from the Gr. *erōs*, love), relating to love.—*Pro* *poet* *h* *erotic* poetry.—The name of *erotic* writers has been applied, in Greek literature, particularly to a class of romance writers, and to the poet of the *Musæon Palæ*.

**Erratics**, or *Erratic blocks*, in geology, boulders or large masses of angular rock which have been transported a distance from their original position, to a great distance during a glacial period. They are found, for example, in the Mountains Innishowen, in Great Britain, and which have travelled considerably from their original situation. Similarly, in the Scottish and Lake-district granites and gneiss rocks (some of which weigh several tons) are found in common in the surface soil of the fertile counties of England.

**Erromango**, or *Erromanga*, one of the more important of the New Hebrides Islands, with an area of about 109 sq. miles, hilly and not very fertile, but with spots well cultivated. Several missionaries have been murdered by the natives—including the missionary John Williams—but perhaps half of the 2500 natives are now Christians.

**Errors of Observation**. In scientific measurements, objects and instruments alike are so constituted that numerical results can only be approximate. We have to find the value of some quantity, not exactly, but to so many significant figures. Even so, when a number of measurements are made of the same quantity, it regularly happens that different values are obtained, the difference between a value so obtained and the true value being called an *error of observation*. It remains to combine the various measurements in such a way as to obtain the best result which they are capable of yielding.

The usual method is to take the arithmetic

mean of the values obtained as the correct value. It is also customary in careful work to state the average deviation of the observed values from the mean. For example, various experimenters found the following numbers for the charge on an electron: 1.67, 1.77, 1.65, 1.70, 1.60. Here the *mean* is 1.71, and the average *deviation* from the mean, taken without regard to algebraic sign, is .05. The final result is stated as  $1.71 \pm .05$ . The ambiguous term  $\pm .05$  is sometimes called the *probable error*. The smaller the probable error, the more reliable is the mean result.

A case of much practical importance occurs when the results obtained by two distinct methods differ by greater amounts than can be accounted for by the uncertainty of either result. In this case there must be a *constant error* present in at least one of the sets of measurements. Recognition of a constant error has occasionally led to an important discovery; for instance, the hint which led to the detection of argon in the atmosphere came from the observed discrepancy in the densities of atmospheric nitrogen and nitrogen from ammonia.

In many measurements what is sought is not the value of a single quantity, but the relation between the values of two variable quantities. In such cases graphical methods are of great service. Corresponding values of the two variables are found and plotted; and a smooth curve, or it may be a straight line, is drawn to lie as evenly as possible among the plotted points. Where great accuracy is wanted, analytical methods are also available. See *Squares, Method of Least; Probability*.

**Ersch** (ersh), John Samuel, German bibliographer, born 1746, died 1828. He was principal librarian and professor of geography and statistics at Halle. Among his publications are: a *Dictionary of French Writers*; a *Manual of German Literature*; and, in connection with Gruber, the *Universal Encyclopedia of Arts and Sciences*.

**Ers'kine**, Ebenezer, the founder of the Secession Church in Scotland, born 1680, died 1754. He studied at Edinburgh, and was ordained minister of Portmank, in Fife, in 1708, in which situation he continued for twenty-eight years, when he removed to Stirling. His attitude towards patronage and other abuses in the Church led to his being deposed, when, in conjunction with his brother and others, he founded the Secession Church. Erskine was the leader of the Burghers (q.v.). He is the author of several volumes of sermons.

**Erskine**, The Hon. Henry, Scottish barrister, was the third son of Henry David, tenth Earl of Buchan; born at Edinburgh 1740, died 1817. After studying at the Universities of St. Andrews,

Edinburgh, and Glasgow, he adopted the legal profession, and in 1768 was called to the Bar. He twice held the office of Lord-Advocate, was for long the leader of the Scottish Bar, and held a high reputation as a wit.

**Erskine, John**, of Carnock, afterwards of Cardross, Scottish jurist, born 1695, died 1768. He was called to the Scottish Bar in 1719, and was author of *Principles of the Law of Scotland*, and the *Institutes of the Law of Scotland*, both works of authority.

**Erskine, Ralph**, brother of Ebenezer Erskine, born 1685, died 1752. He was ordained to the parish of Dunfermline in 1711, and in 1737 joined his brother, who had seceded from the Established Church. His *Gospel Sonnets* and other religious works were once very popular.

**Erskine, Thomas**, Lord Erskine, Scottish lawyer, the youngest son of the tenth Earl of Buchan, was born in 1750, and died in 1823. He was educated partly at the High School of Edinburgh, and partly at the University of St. Andrews. After serving four years in the navy and seven in the army, he commenced the study of law, and in 1778 both took his degree at Cambridge and was called to the Bar. His success was immediate. In May, 1783, he took silk, and the same year was elected member of Parliament for Portsmouth, a seat he held (except from 1784-90, when he had no seat) till 1806, when he was raised to the peerage. The rights of juries he firmly maintained on all occasions, but particularly in the celebrated trial of the Deaf of St. Asaph for libel. In 1789 he defended Stockdale, a bookseller, for publishing what was charged as a libellous pamphlet in favour of Warren Hastings. In 1792, being employed to defend Thomas Paine, when prosecuted for the second part of his work *The Rights of Man*, he declared that, waiving all personal convictions, he deemed it right, as an English advocate, to obey the call: by the maintenance of which principle he lost his office of Attorney-General to the Prince of Wales. In the trials of Hardy, Tooke, and others for high treason in 1794, which lasted for several weeks, the ability displayed by Erskine was acknowledged by all parties. He was a warm partisan of Fox, and a strenuous opposer of the war with France. In 1802 the Prince of Wales not only restored him to his office of Attorney-General, but made him Keeper of Seals for the Duchy of Cornwall. On the death of Pitt, in 1806, Erskine was created a peer, and raised to the dignity of Lord Chancellor. During his short tenure of office the Bill for the abolition of slavery was passed. After he retired with the usual pension, he took little part in politics.

**Eruptive Rocks**, in geology, those which, as lavas, have broken through other rocks while in

a molten state, and become eruptive at the surface.

**Ervum**. See *Lentil*.

**Eryngium**, a genus of plants belonging to the nat. ord. Umbellifere. There are upwards of 100 species found in temperate and sub-tropical climates, but chiefly in South America. *E. maritimum*, also called sea-holly, is the only truly native British species. It frequents sandy shores, and is distinguished by its rigid, spiny, glaucous, veined leaves, and its dense heads of blue flowers. The roots are sometimes candied, and are reputed to be stimulating and restorative, as well as to have aphrodisiac properties. It is mentioned by Shakespeare, *Merry Wives*, v, 5, 23, as an aphrodisiac.

**Erysip'elas**, Rose, or St. Anthony's Fire, is a contagious disease of the skin due to infection by a germ, the Streptococcus, and accompanied by severe general disturbance. Cold, damp weather favours its appearance. It rarely affects those under fifteen years, and is commoner in women than men. The disease is characterized by sudden onset, with shivering, headache, vomiting, and occasionally sore throat, followed by the appearance of the typical erysipelatous flush on the skin of the affected part, most usually the face. This part becomes deep red, and is much swollen, with a glossy, tender surface. It is definitely raised, and has a spreading edge merging into the normal parts around. In extreme cases there is marked disfigurement. Local treatment to allay pain and prevent spreading is by the application of lotions and ointments, and general treatment in the form of stimulating foods is given to maintain strength. Serum treatment has been used, but so far there have been very conflicting results. The disease is not so common nor so fatal as previously.

**Erysipha'les**, an important family of ascomycetous Fungi, distinguished by the presence of typical sexual organs and closed ascus-fruits (*cleistocarps*) which bear characteristic appendages connected with dispersal; also by the fact that each segment of the septate mycelium contains a single nucleus. They are all parasites, appearing on leaves, stems, or fruits as white patches of mycelium ('mildew'). During summer innumerable conidia are produced, which spread the disease rapidly; in autumn the black ascus-fruits develop and carry the fungus through the winter. Erysiphales are responsible for many important plant-diseases, e.g. the mildew of hops (*Sphaerotheca Castagnei*), vine (*Uncinula spiralis*), wheat (*Erysiphe communis*), and the American gooseberry mildew (*Sphaerotheca Mors-uvae*), a 'notifiable' disease in Britain.

**Erythe'ma** is redness of the skin, and in this sense is applied to a number of general conditions which bring about redness of the skin, e.g.

abscess, oedema, scarlet fever, &c. Of late, in medicine, its use has been more restricted, and refers only to an inflammation of part of the skin. This disease is characterized by redness and tenderness, and may become sufficiently severe to lead to the production of bullæ in the centre of the affected part. Dermatologists recognize various types of erythema.

**Erythræan Sea**, in ancient geography, a name given to what is now called the Indian Ocean, but including the Persian and Arabian Gulfs. The name was eventually restricted to the Arabian Gulf.

**Erythrina**. See *Coral Tree*.

**Erythronium**. See *Dog's Tooth Violet*.

**Erythrophloeum**, a genus of tropical trees, nat. ord. Leguminosæ, containing three species, two found in Africa and the third in Australia. The *E. guineense* of Guinea has a poisonous juice, which is used by the natives as a test of innocence and guilt, hence the name 'ordeal tree'.

**Eryx**, an ancient city and a mountain in the west of Sicily, about 2 miles from the sea-coast. The mountain, now Monte San Giuliano, rises direct from the plain to a height of 2184 feet. On the summit anciently stood a celebrated temple of Venus. All traces of the ancient town of Eryx have now disappeared, and its site is occupied by the modern town of San Giuliano.

**Erzberger**, Matthias, German politician, born at Bittenhausen in 1875. Educated at Freiburg, where he studied political economy, he took an interest in 1897 in the Christian Socialist movement, and entered the Reichstag as a member of the Centre or Catholic party. He became prominent in 1917, when he accused the German Government of misrepresenting the military situation, and urged for a statement of Germany's peace aims. Secretary of State in 1918, he became Minister of Finance in 1919 in Bauer's Cabinet, but was compelled to resign in 1920. He was murdered on 26th Aug., 1921, by two young men of the militarist party.

**Erzerum**, **Erzeroum**, or **Erzeroom** (er'ze-rom), a city of Armenia, formerly the capital of a Turkish vilayet with an area of 27,000 sq. miles, and a pop. of 582,745. The town is about 6000 feet above sea-level, and forms an important strategical centre. It is irregularly built, its narrow dirty streets, flanked by mean houses, being crowded together in the small space enclosed by its lofty walls. The Moslem element prevails largely over the Christian, although it is the metropolis of the Armenian Church in union with Rome. In addition to important manufactures, especially in copper and iron, it carries on an extensive trade, and is a chief halting-place for Persian pilgrims on their way to Mecca. The town was captured by the Rus-

sians in Feb., 1916, and recaptured by the Turks in March, 1918. Pop. (before the European War), about 80,000.

**Erzgebirge** (erts'ge-bir-ge; 'Ore Mountains'), a chain of European mountains forming a natural boundary between Saxony and Bohemia, nearly 120 miles in length and 25 miles broad. The highest summits, which are on the side of Saxony, rise to 3800 or 3900 feet. The mountains are rich in silver, iron, copper, lead, cobalt, and arsenic.

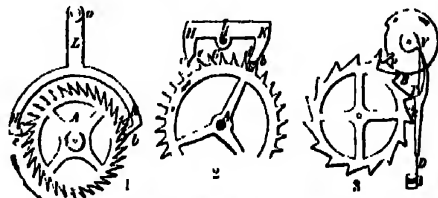
**Esarhad'don** (Assyr. *Asur-akhi-iddina*, *Asur* has given a brother), the son of Sennacherib, and one of the most powerful of all the Assyrian monarchs. He extended the empire on all sides, and is the only Assyrian monarch who actually reigned at Babylon. He died about 667 B.C.

**E'sau**, the eldest son of Isaac, and twin-brother of Jacob. His name (which signifies rough, hairy) was due to his singular appearance at birth, being "red, and all over like an hairy garment". The story of his losing the paternal blessing through the craft of Rebekah and Jacob, with other facts, is told in *Genesis*, xxvii. He was the progenitor of the Edomites.

**Esbjerg**, a Danish seaport in South-West Jutland, opposite the Island of Fanø. Pop. 18,000.

**Escallonia**, a genus of suffrutescent shrubs and trees, natives chiefly of the Andes. *E. rubra* is a handsome evergreen shrub, with shiny, resinous, aromatic leaves, and fine pink flowers; it is hardy in many parts of Britain, and makes an excellent hedge, especially near the sea, where it bears the salt-laden winds without damage.

**Escape'ment**, the general contrivance in a



1, Dead-beat or repose escapement. The pallets are concentric with the axis *a*, and thus while a tooth is against the pallet the wheel is stationary. 2, Recoil escapement. The pallets are not concentric to the axis *a*, and therefore a slight recoil of the wheel takes place after the escape of a tooth (whence the name escapement). When the pallets leave a tooth, the teeth slide along their surfaces, giving an impulse to the pendulum. Lettering for 1 and 2. The anchor *h* 1, *k* is made to oscillate on the axis *a* by the pendulum. The teeth of the escapement-wheel *A* come alternately against the outer surface of the pallet *k* and the inner surface of the pallet *h*. 3, Chronometer escapement. As the balance rotates in the direction of the arrow, the tooth *v* presses the spring against the lever, thus pressing aside the lever and removing the detent from the tooth of the wheel. As the balance returns, *v* presses aside and passes the spring without moving the lever, which then rests against the stop *z*.

timepiece by which the pressure of the wheels (which move always in one direction) and the vibratory motion of the pendulum or balance-

wheel are accommodated the one to the other. By this contrivance the wheelwork is made to communicate an impulse to the regulating power (which in a clock is the pendulum and in a watch the balance-wheel), so as to restore to it the small portion of force which it loses in every vibration, in consequence of friction and the resistance of the air. The leading requisite of a good escapement is that the impulse communicated to the pendulum or balance-wheel shall be invariable, notwithstanding any irregularity or foulness in the train of wheels. Various kinds of escapements have been contrived, some of which are shown in the accompanying figure. See *Clock*; *Watch*.

**Es'car**, or **Esker**, a geological formation in the superficial drift, generally consisting of a long linear ridge of sand and gravel, sometimes including blocks of considerable size. The materials are derived from the waste of till or boulder-clay, and their arrangement took place probably in water flowing in channels beneath ice-sheets, the eskar becoming exposed as the ice finally melted away. In Sweden eskars have been formed, season by season, at the mouths of glacier-tunnels as the ice shrank back, the ice-front opening on a lake. See *Kames*.

**Eschar** (es'kâr), a slough or portion of dead or disorganized tissue. The name is commonly applied to the crust or scab occasioned on the skin by burns or caustic applications.

**Eschatology** (es-ku-; Gr. *eschatos*, last, and *logia*, account), in theology, the 'doctrine respecting the last things', which treats of the millennium, the second advent of Christ, the resurrection, judgment, conflagration of the world, and the final state of the dead.

**Escheat** (es-chêt'), in law, a species of reversion arising from default of heirs. Lands, if freehold, escheat to the king or other lord of the manor; if copyhold, to the lord of the manor. By modern legislation there can be no escheat on failure of the whole blood wherever there are persons of the half-blood capable of inheriting.

**Eschenbach** (esh'en-bâh), Wolfram von, German mediæval poet or minnesinger, flourished in the first half of the thirteenth century. The most esteemed of his numerous works are: *The Parzival* (printed 1477); *The Titivel*, or *The Guardian of the Graal* (printed 1477); and *The Willehalm*, a poem on the deeds of William of Orange, a contemporary of Charlemagne.

**Eschscholtzia** (esh-sholt'si-a), a small genus of glabrous whitish plants, of the poppy order, natives of California and the neighbouring regions. They have divided leaves, and yellow peduncled flowers. The sepals cohere and fall off as the flower opens in the form of a cap. They are now common in the gardens of Great Britain.

**Eschwege** (esh'vâ-ge), a town of Prussia,

province of Hesse-Nassau, on the Werra, 26 miles E.S.E. of Cassel. Pop. 12,540.

**Eschweiler** (esh'vl-ler), a town of Prussia, in the province of Rheinland, 9 miles E.N.E. of Ayl-Chapelle, on the Inde. It is the seat of large and varied manufacturing industries, especially in iron, copper, and zinc, and has coal-mines. Pop. 24,718.

**Escobar y Mendoza** (es-ko-bâr' é men-do-thâ), Antonio, a Spanish casulist and Jesuit, born 1580, died 1660. His principal works are: *Summula Casuum Conscientiæ*, and several scriptural commentaries. His casuistry was severely criticized by Pascal in his *Lettres Provinciales*, and the extreme laxity of his moral principles was ridiculed by Boileau, Molière, and La Fontaine.

**Escrow**, a legal writing delivered to a third person to be delivered by him to the person whom it purports to benefit, when some condition is performed. Upon the performance of this condition it becomes an absolute deed, but if the condition be not performed, it remains an *escrow* or scroll.

**Escu'rial** (Sp. *el Escorial*), a remarkable building in Spain, comprising at once a palace, a convent, a church, and a mausoleum. It is distant from Madrid about 24 miles in a north-westerly direction, and situated on the acclivity of the Sierra Guadarrama, the range of mountains which divides New from Old Castile. It was built by Philip II, and dedicated to St. Lawrence, in commemoration of the victory of St. Quentin, fought on the festival of the saint in 1557. It is popularly considered to be built on the plan of a gridiron, from the fact that St. Lawrence is said to have been broiled alive on a sort of large gridiron. The building is a rectangular parallelogram measuring 744 feet in length by 580 feet in breadth. The interior is divided into courts, formerly inhabited by monks and ecclesiastics, while a projection 400 feet in length (the handle of the gridiron) contains the royal palace. It was begun in 1503 and finished in 1584. It is of moderate height, and its innumerable windows (said to be 11,000) give it (apart from the church) somewhat the aspect of a large mill or barracks. The church is the finest portion of the whole building. The dome is 60 feet in diameter, and its height at the centre is about 320 feet. Under it is the Pantheon or family vault of the Spanish sovereigns. The library contains a valuable collection, including a rich store of Arabic MSS. The Escorial was partly burned in 1671, when many MSS. were destroyed, and was pillaged by the French in 1808 and 1813. It was restored by Ferdinand VII, but the monks, with their revenues which supported it, have long since disappeared. In 1872 it was fired by lightning, and suffered serious damage.—Cf. A. F. Calvert, *The Escorial*.

**Esdra'lon**, *Plain of*, a fertile plain in Northern Palestine, between the Mediterranean and the Jordan, drained by the River Kishon, and now traversed by the railway from Haifa to Damascus. This plain is celebrated for four battles having been fought there. Sisera was defeated there; Gideon and his three hundred won a battle there; Saul and Jonathan fought there; and it was there that Josiah was killed. In the centre of the plain is Megiddo (q.v.), identified with Armageddon (*Rev.* xvi, 16). Allenby won a great victory here in Sept., 1918.

**Esdra's**, *Books of*, two apocryphal books, which, in the *Vulgate* and other editions, are incorporated with the canonical books of Scripture. In the *Vulgate* the canonical books of *Ezra* and *Nehemiah* are called the first and second, and the apocryphal books the third and fourth books of *Esdra's*. The *Geneva Bible* (1500) first adopted the present nomenclature, calling the two apocryphal books first and second *Esdra's*. The subject of the first book of *Esdra's* is the same as that of *Ezra* and *Nehemiah*, and in general it appears to be copied from the canonical Scriptures. The second book of *Esdra's* is supposed to have been either of much later date or to have been interpolated by Christian writers.

**E'serin**, or **Physostigmin**, a drug obtained from Calabar bean, the active principle of this plant, used as a remedy in cases of tetanus (lock-jaw). A solution of eserin dropped in the eye causes contraction of the pupil, and hence its use in some eye ailments, as, for instance, glaucoma.

**Esher**, a village and parish of England, north-west Surrey. Here is Claremont, built by Sir John Vanbrugh, in 1816 settled upon Princess Charlotte and her husband, afterwards the residence of the Orleans family when expelled from France. The so-called 'Wolsey's Tower' is the gatehouse of a palace built by William Wyndham, Bishop of Winchester. Pop. 2600.

**Esk** (Celtic for water), the name of two small rivers in England—one in Cumberland and the other in Yorkshire; and of several in Scotland, the chief being the Esk in Dumfriesshire, the North Esk and South Esk in Forfarshire, and the North Esk and South Esk in Edinburghshire.

**Eski-jumna**, a town of Bulgaria, on the northern slope of the Binar-Dagh. Pop. 10,000.

**Eskilstu'na**, a town of Sweden, on a river of the same name connecting Lake Maelar with Lake Hjelmar, with ironworks and manufactures of steel goods and weapons. It is named after St. Eskil, the English apostle of Christianity in Södermanland. Pop. 28,500.

**Es'kimos**. See *Esquimaux*.

**Eski-Sagra**, or **Stara-Zagora**, a town of Vol. IV.

Bulgaria, on the south slope of the Balkans, 50 miles N.E. of Philippopolis. In its vicinity are extensive rose-gardens, orchards, and mineral springs. Pop. 28,480.

**Eski-Shehr**, a town of Asia Minor, 90 miles S.E. of the Sea of Marmora, with warm baths and manufactures of meerschaum pipes. Fighting took place near the town in 1921, between the Greeks and Turks. Pop. 20,000.

**Esmarch** (es'märk), Johannes Friedrich August von, German surgeon, born in 1823, died in 1908. He held high official positions during the Schleswig-Holstein and Franco-German Wars, and was a great authority on gunshot wounds. He also originated valuable improvements in barrack-hospitals and ambulances, introduced the antiseptic treatment into Germany, and was the author of several surgical works.

**Es'neh**, a town of Upper Egypt, on the left bank of the Nile, 28 miles S.S.W. of Thebes, on the site of the ancient Latopolis, now easily reached by railway and river. Among the ruins there is a beautiful portico of twenty-four lofty and massive columns, belonging to a temple of Kneph (the only portion of the temple cleared out), and erected in the Ptolemaic and Roman period, with a zodiac on the ceiling. Esneh has a caravan trade, manufactures cottons and pottery, and is very healthy. There is an irrigation barrage here. Pop. 15,800.

**Esoc'idæ**, the family of fishes to which the true pike (*Esox lucius*) belongs, as also the much larger muskellong (*E. nobilior*) of America.

**Espal'ter**, in gardening, a sort of trelliswork on which the branches of fruit trees or bushes are extended horizontally, with the object of securing for the plant a freer circulation of air as well as a full exposure to the sun. Trees thus trained are not subjected to such marked nor so rapid variations of temperature as wall trees.

**Espartero** (es-par-tá'ro), Baldomero, Duke of Vittoria, a Spanish statesman, born 1792, died 1870. The son of a wheelwright, he was educated for the priesthood, but joined the army as a volunteer in 1808. He took a leading part in the conflict with the Carlists, and was one of the most prominent men in Spain during several decades of the nineteenth century. He was regent of the kingdom from 1841 to 1843, and again head of the Government from 1854 to 1856. He was exiled to England for several years (1843-7). In 1870 his name was vaguely put forward in the Cortes as a candidate for the throne, but the proposal was not supported with any enthusiasm, and the closing years of his life were spent in retirement.

**Espar'to**, or **Alfa**, a plant growing in Spain and North Africa, long applied to the manufacture of cordage and matting, and also extensively used for paper-making. This plant, called by

botanists *Stipa* or *Macrochloa tenacissima*, is a species of grass 2 to 4 feet high, covering large tracts in its native regions, and also cultivated, especially in Spain.

Esperanto, an artificial language for international use invented by Dr. Zamenhof of Warsaw, who first published an account of it in 1887. The language was afterwards taken up for practical purposes in many countries, its use being promoted by special societies and periodicals. Its structure is so simple that the whole grammar can be completely mastered in an hour. There are no exceptions to the rules, perfect regularity being a leading feature of the language. The essential roots number only some 2000, including grammatical inflexions, prefixes, and suffixes, and these are chosen from the principal European languages in such a way as to make their mastery easy to any person of ordinary education. The alphabet consists of twenty-eight letters, each with an invariable sound. There are no silent letters. The accent is always on the penultimate syllable. All nouns end in *-o* in the singular,



Esposito or Alfa

and all adjectives in *-a*. The plural of these is formed by adding *-j* (pronounced *y*). All derived adverbs end in *-e*. The only case inflexion is *-n* for the objective. The verbal endings are: *-i* for the infinitive; *-as*, *-is*, *-os* for the present, past, and future tenses respectively; *-us* for the conditional; *-u* for the imperative; *-anta*, *-inta*, *-onta* for the present, past, and future participles active respectively; *-ata*, *-ita*, *-ota* for the present, past, and future participles passive respectively. The definite article is *la* in all cases and numbers, and there is no indefinite

article. An ingenious system of prefixes and suffixes enables all shades of meaning to be expressed. Thus: *bona*, good, *malbona*, evil; *patro*, father, *patrino*, mother; *gepatroj*, parents; *kudri*, to sew, *kudrilo*, needle; *arbo*, tree, *arbaro*, forest; *bela*, beautiful, *belco*, beauty; *morti*, to die, *mortigi*, to kill. The following is the Lord's Prayer in Esperanto: *Patro Nia, kin estas en la cielo, sankta estu Via nomo. Venu regero Via. Estu furata volo Via, kiel en la cielo, tiel ankaŭ sur la tero. Panon nian ĉiutagan donu al ni hodiaŭ, kaj pardonu al ni ŝuldojn niajn, kiel ni ankaŭ pardonas al niaj ŝuldintoj. Ne konduku nin en tenton; sed liberigu nin de la malbono: car Via estas la regado, la forto, kaj la gloro eterne. Amen!* The British Esperanto Association was founded in the autumn of 1904; its official organ is *The British Esperantist*. International Esperanto congresses have been held since 1905, the last in 1920 at the Hague.—BIBLIOGRAPHY: J. C. O'Connor, *Esperanto: the Student's Complete Text-Book* (revised by Dr. Zamenhof); Underhill, *Esperanto and its Availability for Scientific Writings*.

Espionage (from the French word *espion*, a spy) is the acquirement of information by secret methods and by special agents, as opposed to its acquirement openly by combatants in the ordinary course of military operations. Espionage is recognized by international law under the Hague Convention, Article 24 of the Annex to which reads as follows: "Ruses of war and the employment of measures necessary for obtaining information about the enemy and the country are considered permissible". The right given by this rule does not, however, extend to the employment of force to extract information from enemy subjects as to their own armies, so that it follows that methods of espionage must be of a persuasive, and, so to speak, peaceful nature.

Espionage is carried on both in peace and war, but the conditions under which secret service agents work differ to a very marked extent according to the state of affairs between the two countries. In peace-time, though many countries maintain secret service agents in other states, yet these same agents can expect no assistance from their Governments in the event of their being detected. In this case it is a diplomatic fiction that nothing is known of them or of the reasons for their activities. The agent, therefore, in consideration of a sufficient allowance, takes the risk of a lengthy term of imprisonment if he is so unfortunate as to be found out.

In time of war the condition of non-interference naturally exists as a matter of course, and the secret service agent or spy is liable to the death penalty if discovered, and the fact that he has or has not obtained and transmitted information does not affect the case. In time of



peace every nation of any importance maintains representatives in other states. Among the recognized duties of these representatives is the obtaining and transmitting of information about naval and military matters which may be of interest to their Governments. This is not regarded as espionage provided the information is obtained by the representative in his official capacity; it becomes so when resort is had to disguise or dissimulation, and, in fact, dissimulation is the essence of the offence. It follows, therefore, that a spy—one who practises espionage—must act in a clandestine manner in order to bring himself within the technical definition of the offence (by international law).

The characteristics of the act of spying are laid down in Article 29 of the Hague Convention, and the definition there given is as follows: "A person can only be considered a spy when, acting clandestinely or on false pretences, he obtains or endeavours to obtain information in the zone of operations of a belligerent, with the intention of communicating it to the hostile party . . .".

From this definition it appears that action in the 'zone of operations' is a necessary concomitant of the offence, and that, therefore, persons operating outside that zone cannot technically be charged with espionage; and to a certain extent this is so. A person may be domiciled in a belligerent country, and may, while pursuing his ordinary vocation, collect and transmit openly information of value to his own country; in the absence of dissimulation, such a person could not be charged with espionage, though he could be with war-treason. As, by international law, war-treason is punishable by death, the result is the same as if all the characteristics of spying had been present.

Espionage has been brought to a fine art in many countries, and complex organizations for its practice exist. Information may conceivably be collected with comparative ease by trained agents, but it is when it comes to disposing of that information that the troubles of the secret service agent begin. A poison requires an antidote, and the system of counter-espionage to a great extent provides this antidote. In accordance with this system, steps are taken to mark down and know all secret-service agents engaged in espionage work in the country concerned; their operations are then followed and, to a certain extent, controlled till such time as the psychological moment arrives when all, including the master-brain, are drawn into the net and disposed of.

In a military sense a spy means a man, whether soldier or civilian, who penetrates in disguise behind the enemy lines and brings back information about his dispositions. By the customs of war the penalty inflicted on a spy caught in

the act is death after trial; but should a man known to have acted as a spy on some former occasion be subsequently captured in the course of military operations, he cannot be punished for his former act, and must be treated as a prisoner of war.

The following examples may serve to show what can be considered spying and what cannot. 'A', a soldier, in presence of the enemy, volunteers to obtain exact information as to the strength of a certain hostile post. To this end he, wearing his uniform and carrying a weapon of some kind, approaches the post by stealth, and secretes himself in a convenient place for seeing and hearing. If he is discovered, and attempts to escape, he may be shot in the process; but if he is captured, he must be treated as a prisoner of war and not as a spy. 'B', another soldier, speaking the enemy language, disguises himself as an officer of the enemy forces, and in this disguise penetrates behind the lines and mixes with the enemy troops. On discovery and capture he may be tried as a spy and shot.

In the first case 'A' was acting as a combatant in the ordinary course of military operations, and no disguise was present; in the second case 'B' was acting clandestinely and under false pretences, i.e. was masquerading as an officer of the enemy forces, and the necessary dissimulation was present.

**Espir'ito-Santo** ('Holy Spirit'), one of the maritime states of Brazil, bounded north by Bahia, south by Rio-de-Janeiro; length, about 200 miles; breadth, about 120 miles; area, 17,810 sq. miles. Pop. 434,500.

**Espir'itu-Santo**, an island of the Pacific, the largest of the New Hebrides, with some 20,000 inhabitants.

**Esprits Forts** (Fr., bold spirits), a term applied to the French school of freethinkers, which included Voltaire, Diderot, Helvetius, D'Alembert, and others. The Esprits Forts, are, however, distinguished from the English freethinkers. Whilst the latter were only aiming at freedom of religious thought, the Esprits Forts were more radical and revolutionary, seeking to bring about the abolition of the existing order and the substitution of a system based upon pure reason and the supremacy of intellect.

**Esquimault** (es-kwi'mált), a harbour and naval station on the south-east coast of Vancouver Island, about 8 miles from Victoria, the capital of British Columbia. The harbour is almost landlocked, and, with the 'Roynl Roads' outside, is capable of giving safe anchorage to a fleet of vessels of the largest size. It is the station of H.M. ships on the Pacific coast, is a fortified naval arsenal, and since 1906 has been garrisoned by Canadian troops.

**Esquimaux** (es'ki-mōz), or **Eskimos**, a race inhabiting the Arctic coasts of North America, from Greenland to Behring's Strait, and extending into Asia. They call themselves *Inuit*, 'the people', 'men'; their other name is from an Algonquian word signifying eaters of raw flesh, and seems to have been given them first by the Jesuit Father Blard in 1611. They consist of three principal stocks - the Greenlanders; the Esquimaux proper, in Labrador; and the Western Esquimaux, found along Hudson's Bay, the west side of Baffin's Bay, the polar shores as far as the mouths of the Coppermine and Mackenzie Rivers, and both on the American and Asiatic sides of Behring's Strait. The entire Eskimo population is estimated at 27,000, of which 15,000 live in North America and 11,000 in Greenland. Their leading physical peculiarities are a stunted stature, flattened nose, projecting cheek-bones, eyes often oblique, and yellow and brownish skin. Seal-skins, reindeer and other furs are used as materials for dress, according to the season, as well as skins of otters, foxes, and martens. In summer they live in tents, covered with skins; in winter they may be said to burrow beneath the snow. In Greenland houses built of stone and cemented with turf are used as permanent habitations. Vegetation being extremely stunted within the limits of their territories, their food consists of the flesh of whales, seals, and walruscs, often eaten raw; and they show remarkable skill in fishing and hunting. Their weapons are bows and arrows, spears or lances, generally pointed with bone, but sometimes with metal. Their only domestic animal is the Esquimaux dog. In intellect they are by no means deficient; in manners they are kind and hospitable. Their religious ideas appear scanty, but success has attended the labours of the Danish missionaries in teaching them the Christian religion.—**BIBLIOGRAPHY:** H. Rink, *Tales and Traditions of the Eskimo*; V. Stefansson, *My Life with the Eskimo*.

**Esquimaux Dog**, or **Eskimo Dog**, a breed of dogs extensively spread over the northern regions of America and of Eastern Asia. It is rather larger than the English pointer, but appears smaller on account of the shortness of its legs. It has oblique eyes, an elongated muzzle, and a bushy tail, which give it a wolfish appearance. The colour is generally a deep dun, obscurely barred and patched with darker colour. It is the only beast of burden in these latitudes, and with a team of such dogs attached to his sledge the Eskimo will cover 60 miles a day for several successive days.

**Esquire** (O.Fr. *escuyer*, from Lat. *scutum*, a shield); originally, a shield-bearer or armour-bearer; an attendant on a knight; hence in modern times a title of dignity next in degree

below a knight. In England this title is properly given to the younger sons of noblemen, to officers of the king's courts and of the household, to counsellors at law, justices of the peace while in commission, sheriffs, gentlemen who have held commissions in the army and navy, &c. It is usually given to all professional and literary men, and nowadays, in the addresses of letters, *esquire* may be put as a complimentary adjunct to almost any person's name. In heraldry the helmet of an *esquire* is represented sideways, with the vizor closed.

**Esquiros** (es-ké-ros), Henri Alphonse, French poet, romancist, and miscellaneous writer, born at Paris 1812, died at Versailles 1870. His first work, a volume of poetry, *Les Hirondelles*, appeared in 1834. This was followed by numerous romances, and a commentary on the life of Christ (*L'Évangile du Peuple*), for which he was prosecuted and imprisoned. He then published *Les Chants d'un Prisonnier*, poems written in prison; *Les Vierges Folles*; *Les Vierges Sages*; *L'Histoire des Montagnards*. Having to leave France in 1851, he resided for years in England, and wrote a series of essays for the *Revue des Deux Mondes* on English life and character, which were translated under the title of *The English at Home*, and were very popular. He also wrote a similar work on the Dutch. Other works are: *Religious Life in England*, and *Charlotte Corday*.

**Essad Toptani**, Pasha, Albanian soldier and national leader, born at Tirana in 1856. He was a descendant of the Toptani family who had ruled in Albania in the fifteenth century. Trained for the army, he served in Macedonia and Anatolia, and in 1897 was rewarded with the title of Pasha for his services in the war against Greece. Abdul Hamid, however, who feared the power of the Toptani family, had the brother of Essad Pasha murdered, and the latter became the mortal enemy of the Sultan. He nevertheless accepted the rank of brigadier-general, and commanded the local troops at Janina. In 1908 he joined the Young Turks, and was one of the deputation which brought the news of his deposition to the Sultan. He was in command of the troops at Scutari, when the powers declared in favour of the autonomy of Albania in 1912. Essad Pasha had hoped to be chosen ruler of the new state of Albania created by the Treaty of London, but as the Prince of Wied had been appointed *mbret*, he accepted the office of Minister of War and of the Interior. Suspected by the *mbret*, he was compelled to flee from Durazzo. After the departure of the Prince of Wied, at the outbreak of the European War, he returned to Durazzo, and was appointed by the Senate (on 5th Oct., 1914) President of the Provisional Government. In spite of Austrian

advances he declared war on the Central Powers, and escaped when the Austrians entered Albania. He rendered valuable services to the Allies at Salonica, but the Italians, who saw in the Pasha an enemy to their own views upon Albania, refused to grant him permission to return to his country. Essad Pasha, therefore, remained in Paris, where he was assassinated by an Albanian student named Averic Rustem on 13th June, 1920. The assassin was acquitted by a French jury in December of the same year, prominent Albanians having pleaded in favour of the murderer, and maintained that the Pasha was an ambitious adventurer and a traitor to his country.

**Es'say**, a composition in which something is attempted to be proved or illustrated, usually shorter and less methodical and finished than a systematic or formal treatise; so that it may be a short disquisition on a subject of taste, philosophy, or common life. The essay was the invention of Montaigne in the sixteenth century, and Francis Bacon was another illustrious author who employed the literary form of the essay. Caution or modesty has induced many writers of note to give the title of essay to their most elaborate productions: thus we have Locke's *Essay on the Human Understanding*. There is a class of English writers to whom the descriptive term *essayist* is applied, the most illustrious being Addison, Steele, Charles Lamb, Hazlitt, De Quincey, Macaulay, Carlyle, Froude, Matthew Arnold, R. L. Stevenson, and Austin Dobson.

**Essen**, a town of Rhenish Prussia, situated between the Ruhr and the Emscher, 18 miles north-east of Düsseldorf, founded in the ninth century, and adorned with a fine church dating from 873. It increased with great rapidity, and became celebrated for the steel and ironworks of Krupp, the most extensive in Europe, employing till the end of the European War over 27,000 workmen. This great establishment was started in 1827 with only two workmen. In March and April, 1920, heavy fighting took place at Essen between the Government and the Communist troops. Pop. (1910), 294,620.

**Essenes** (es-sēnz'), or **Essæans**, a sect among the Jews, the origin of which is unknown, as well as the etymology of their name. The word may be a derivation from the Syr. *hasya*, the pious ones, or *dyd*, physician. The Essenes appear to have sprung up in the course of the century preceding the Christian era, and disappeared on the dispersion of the Jews after the siege of Jerusalem. The sect appears to have been an outcome of Jewish mysticism and asceticism, which gradually assumed the form of a distinct organization. They were remarkable for their strictness and abstinence, and had a rule of life analogous to that of a monastic order. Property was owned in common.

**Essential Oils**. An essential oil is distinguished from a fatty oil by its characteristic odour, and by being slightly soluble in water and more volatile. Most of the essential oils are decomposed by alkali, but they do not yield soaps as do the fatty oils. An essential oil usually contains one chief ingredient, which may be a compound of carbon and hydrogen, e.g. *turpentine*, in which the characteristic odour is due to *pinene* (C<sub>10</sub>H<sub>16</sub>); or a compound of carbon, hydrogen, and oxygen, e.g. bitter almond oil where the chief ingredient is *benzaldehyde* (C<sub>6</sub>H<sub>5</sub>CHO); or *cinnamon bark*, containing *cinnamic aldehyde* (C<sub>6</sub>H<sub>5</sub>CH=CH·CHO). The extraction of these oils from plants containing them is usually accomplished by a process of distillation with water. In some cases this is not practicable, as the oil may be decomposed by water, e.g. to obtain the essential oil from violets the flowers are macerated with hot lard; the fat absorbs the essential oil, which is then extracted from the lard by means of alcohol. In other cases the oil is extracted by means of a solvent such as petroleum spirit. Large quantities of essential oils are extracted yearly for the preparation of perfumes, the preparation of various flavourings (essences), and for use in the soap industry. Many essential oils are now manufactured synthetically, e.g. oil of wintergreen owes its fragrance to methyl salicylate, pineapple oil to ethylbutyrate, pear oil to amylacetate.

**Essequibo** (es-sē-kē'bō), a river of British Guiana, which flows into the Atlantic by an estuary 20 miles in width after a course of about 450 miles. The district or division of Essequibo is well cultivated and extremely fertile, producing coffee, cotton, cocoa, and sugar. It was the subject of a discussion between the British and Venezuelan Governments, settled by the Arbitration Treaty of 2nd Feb., 1897.

**Essex, Earl of**. See *Cromwell, Thomas*.

**Essex**, Robert Devereux, second Earl of, in the Devereux line, was born at Netherwood, Herefordshire, in 1507. Having appeared at court, he soon became a favourite of Queen Elizabeth, by whom he was kept in attendance against his will during the defeat of the Armada. He served with more or less distinction in expeditions to Portugal and France, the latter on behalf of Henry of Navarre. In 1566 he was commander of the troops in an expedition against Spain, and distinguished himself by the capture of Cadiz. In an expedition next year he was less fortunate, and the queen, with whom he was always quarrelling, received him coldly. Presuming on the favour of Elizabeth, he behaved with rudeness to her at a Privy Council, received a box on the ear, and was told to "go and be hanged". After some months a reconciliation took place, and he was appointed Lord-Lieutenant

of Ireland (1500), which was then in a state of rebellion. He returned to England in September, having been entirely unsuccessful in his government, was made a prisoner in his own house, and foolishly tried to excite an insurrection in London. After a skirmish with a party of soldiers he was compelled to surrender, and sent to the Tower. Tried for treason on 19th Feb., he was executed on 26th Feb., 1601.

**Essex**, a maritime county in the south-east of England, bounded by Suffolk, the Thames, Hertford, and Middlesex; area, 979,532 acres. The surface is generally level, except in the north-west, where it is undulating and sometimes hilly. The soil is in general extremely fertile, and particularly well adapted for the growth of wheat. Beans and pease also thrive uncommonly well. The other principal productions are potatoes, barley, oats, mangolds, turnips, tares, rape, mustard, and trefoil. The raising of caraway, coriander, and tanzel is almost peculiar to this county. It had formerly a great extent of forest, the only survival of which is Epping Forest. The principal rivers in the county are the Roding, Crouch, Chelmer, Blackwater, and Colne. It has also the Thames, Lea, and Stour as boundary rivers. On the coast are some valuable oyster-beds, the oysters from which are exported in considerable quantities. The manufactures of the county are not very extensive, the chief being crape, silks, and straw-plait. The chief towns are: Chelmsford, the county town; West Ham, Colchester, Southend, and Harwich. The county has eight parliamentary divisions, each returning one member. Pop. 1,468,341 (1921).—*Cf. Victoria History of the Counties of England.*

**Esslingen** (es'ling-en), a town of Germany, in Württemberg, on the Neckar, 7 miles s.s.e. of Stuttgart. It is of Roman origin, was long an imperial free town, has walls flanked with towers, a castle, and an ancient Gothic church, dating from the thirteenth century, with a tower 230 feet high. In 1488 the Swabian League was formed at Esslingen. It has manufactures of machinery, articles of wood, cutlery, philosophical instruments, and spinning and other mills. Pop. 32,364.

**Established Church**, a Church having a form of doctrine and government established by law in any country for the teaching of Christianity within its boundaries, and usually endowed by the State. The upholders of the establishment theory maintain that it is the duty of a State to provide for the religious instruction of the people. On the other hand, it is argued that the State has no right to endow or support any particular sect or denomination, unless they assume that that denomination alone is possessed of religious truth and worth. Regarding

the established *Church of England*, see *England*; for *Church of Scotland*, see *Scotland*.

**Estate**, the interest or quantity of interest a man has in lands, tenements, or other effects. Estates are *real* or *personal*. *Real estate* comprises lands, tenements, and hereditaments, held in freehold. *Personal estate* comprises interests for terms of years in lands, tenements, and hereditaments, and property of every other description. *Real estate* descends to heirs; *personal* to executors or administrators. In ordinary language, an estate is a piece of landed property, especially one of some size. *Estate duty*, see *Death Duties*. In political history the term estate is applied to a distinct order or class in society. The term 'fourth-estate' is often used to designate the Press.

**Estates of Scotland**, the name given to a body of similar constitution to the English Parliament, but with important differences, the king himself, as well as his officers, being responsible to the Estates for wrongs done. They held the power of declaring war, or entering on a peace or treaty, and with them rested the right of declaring, with or without the consent of the king, resolutions of the assembly to be law. To prevent a Bill being hurried through Parliament, it was submitted to and discussed by a committee called the *Lords of the Articles*. If sanctioned by this committee, the Bill was passed on to the whole House for approval. Another committee appointed by the Estates was called the *Auditors of Complaints*, whose duty was to hear appeals against the decisions of the king's judges, and, if necessary, to reverse their sentences.

**Estates of the Realm**, in Britain, are the Lords Spiritual, the Lords Temporal, and the Commons. From the circumstance that the Lords Spiritual and Temporal meet in one House, and practically form one branch of the legislature, the popular error has arisen that the sovereign forms one of the three Estates of the Realm.

**Este** (es'tā), a town of North Italy, 16 miles s.w. of Padua. It has a castle, the cradle of the Este family. It has also manufactures of silk goods, earthenware, and majolica; and numerous silk-mills and whetstone quarries. Pop. 11,704.

**Este** (es'tā), one of the most ancient and illustrious families of Italy. In the eleventh century the House of Este became connected by marriage with the German Welfs or Guelphs, and founded the German branch of the House of Este, the Dukes of Brunswick and Hanover. The sovereigns of Ferrara and Modena were of this family, several of them being famous as patrons of letters. The lives of Bionardo, Ariosto, and Tasso were closely connected with members of this House. The last male representative of

the Estes died in 1798. His daughter married a son of the German emperor Francis I, and her grandson disappeared from the land of his forefathers at the consummation of Italian unity in 1869.

**Estella** (es-tel'yá), a town of N.E. Spain, in Navarre, on the Ega, 24 miles south-west of Pampeluna. Pop. 5058.

**Est 'a**, a town of Southern Spain, province of Seville, 50 miles east by south of Seville. It has a handsome Gothic church. Pop. 8284.

**Estepo na**, a seaport of Southern Spain, province of Malaga, 23 miles north-east of Gibraltar. Pop. 9000.

**Esterházy**, a family of Hungarian magnates whose authentic genealogy goes back to the first half of the thirteenth century. They were zealous partisans of the House of Habsburg, to whom, during the reigns of Frederick II and Leopold I, they lent a powerful support. Among the more prominent members of the family are: Paul IV, Prince Esterházy, a general and literary savant, 1675-1713. His grandson, Nicholas Joseph, a great patron of arts and music, founder of the school in which Haydn and Pleyel, among others, were formed, 1714-90. Nicholas, Prince Esterházy, distinguished as a field-marshal and foreign Ambassador, 1765-1838. Prince Paul Anthony, a distinguished and able diplomatist, born 1780, died 1866; was successively Austrian Ambassador at Dresden, Rome, and Britain. He was a supporter of the national Hungarian movement.

**Esters**, or **Ethereal Salts**, in chemistry, a general term for substances formed by the union of an acid and an alcohol with elimination of water. Thus ethyl acetate is formed from ethyl alcohol and acetic acid. Many of them are pleasant-smelling substances.

**Esther**, a Jewess, who became the queen of Xerxes, King of Persia, and whose story is told in the book of the Old Testament called by her name. This book is supposed by some to be the composition of Mordecai himself, the uncle of the heroine. Various opinions are held regarding the time and truth of the story; but the feast of Purim, which commemorates the events narrated, is still observed by the Jews during the month of Adar.

**Estonia**, a new republic of North-Western Europe, formerly a dependency of Imperial Russia, and one of the Baltic Provinces. It is situated south of the Gulf of Finland, and is bounded by Russia, the Republic of Latvia, the Gulf of Riga, and the Baltic. The Republic of Estonia comprises the former Russian government of Estonia, the northern part of Livonia, and the north-western portion of Pskov. The country is divided into nine districts. It has an area of about 23,100 sq. miles, and a pop. of 1,750,000. It has for the most part a flat or

undulating surface. The whole of the north side, however, rises considerably above the sea, and presents to it ranges of cliffs. The Narva is the only river of any importance; but minor streams, as well as small lakes, are very numerous. About a fourth of the surface is covered with forests of pine, birch, and alder. The crops include a little wheat, much barley and oats, and some flax, hops, and tobacco. Cattle are reared, and active fisheries are carried on. The peasantry are almost all of Finnish origin, and speak a Finnish dialect. Five-sixths of the population are Lutherans. Elementary education is compulsory, illiterates numbering about 3 per cent. There is a university at Dorpat, now called Tartu, founded in 1682, and reopened as an Estonian university on 1st Dec., 1919. In the tenth and twelfth centuries Estonia belonged to Denmark; it was afterwards annexed by Sweden, and in 1710 was seized by Russia. Estonia is one of the new states formed in consequence and as a result of the European War. On 24th Feb., 1918, Estonia declared her independence, and was recognized by Great Britain (3rd May, 1918), France, Italy, Japan, Poland, and Sweden. On 31st Dec., 1919, Estonia concluded an armistice with the Bolshevik Government of Moscow, which recognized the republic *de jure*. In 1921 the supreme power was vested in a Constituent Assembly (elected 23rd April, 1919). Estonia was admitted a member of the League of Nations on 22nd Sept., 1921. Reval is the capital.—Cf. M. Martna, *L'Estonie*.

**Eston**, a town of England, North Riding of Yorkshire, 4 miles S.E. of Middlesbrough, with important steelworks and iron-mines. Pop. 30,634.

**Estop'pel** (Fr. *étouper*; Lat. *stuppeare*, to stuff with tow, to cram), in law, anything done by a party himself, which puts a period to an action by closing the ground of controversy. Estoppels are divided into three classes: by Record; by Deed; and in Pais, or by Conduct.

**Esto'vers** (O.Fr. *estover*, need, necessity), in law, necessities or supplies. *Common of estovers* is the liberty of taking the necessary wood for a house or farm from another's estate.

**Estrad'lot**, an Albanian dragon or light-horseman, employed in the French army in the fifteenth and sixteenth centuries. They sometimes fought on foot as well as on horseback.

**Estremadu'ra**, a western division of Spain, consisting of the provinces of Badajoz and Caceres. It is fertile, but not cultivated to its full extent. The Tagus and Guadiana intersect it east to west. Immense flocks of sheep graze on the rich plains. The area is about 16,000 sq. miles, and the pop. 990,000.

**Estremadura**, a maritime province of Portugal, divided by the Tagus into two nearly equal

parts, of which the northern is the more mountainous. Wines and olives are the principal produce. The principal city is Lisbon. Area, 6937 sq. miles. Pop. 1,438,726.

**Estremoz'**, a town of Portugal, in the province of Alentejo, 22 miles west of Elvas. Pop. about 8000.

**Eszek** (cs-sek'), or **Esseg**, a town of Yugoslavia, formerly in Hungary, on the Drave, 13 miles from its confluence with the Danube. It has barracks, town house, normal school, an important trade, and several fairs. Pop. 31,000.

**Étampes** (â-tâpp), a town of France, department of Seine-et-Oise, 30 miles s. by w. of Paris. Pop. 9450.

**Étaples**, a town of Northern France, department of Pas-de-Calais, on the right bank of the estuary of the Canche, 17 miles south of Boulogne. During the European War, Étaples became a place of great importance. It was a huge British encampment, including many hospitals, and a cemetery with over 11,000 graves. It was also of importance as a training-centre, and the famous 'Bull-ring' was there. Pop. 6000.

**Etap'pen** (Ger.), a department in Continental armies the business of which is to relieve the commanders of the field army of all responsibility for their communications in the rear. The officers of this department supervise all arrangements for loading and unloading at stations, forwarding, feeding, and billeting.

**Eta'wah**, a town, Hindustan, United Provinces, capital of district of the same name, on left bank of the Jumna, picturesquely situated among ravines, and richly planted with trees. It has some good buildings, and a considerable trade. Pop. 45,350.—The district has an area of 1694 sq. miles, and a pop. of 700,120.

**Etching**, a method of engraving lines upon a metal plate by means of acid, whence the term has come to denote an impression taken on paper or similar material from the etched plate. Sometimes, though incorrectly, applied to a huc-drawing in pen and ink. The usual process is to cover the plate (generally of copper) with an *etching-ground* of waxes and resins, on which the lines are opened up by means of a sharp-pointed *etching-needle*, either from a design transferred to the ground, or by the artist working directly. The lines are then *bitten* by putting the plate into dilute nitric or hydrochloric acid, the back and edges being protected by *stopping-out varnish*. The plate is removed when the lightest lines are sufficiently bitten. If some lines need deeper biting, the rest may be covered with *stopping-out varnish*, and the plate replaced in the acid; or acid may be applied locally. If a plate is removed before biting is complete, in order to take a trial impression, it is recovered with a transparent ground, addi-

tional lines opened up if necessary, and *rebitten*. In *soft-ground etching*, the ground is mixed with tallow, thin paper laid upon it, and the design firmly drawn thereon with a pencil. When the paper is removed, the ground adheres to it where the lines were drawn. The plate is bitten in the usual way. This produces the effect of a chalk or pencil drawing. *Dry-point* is a method of working direct on to the copper with a sharp point, which raises a *burr* on each side of the line, giving it a characteristic quality. *Dry-point*, etching proper, and engraving proper are often combined in one plate; and a mixture of etching with mezzotint or aquatint is not uncommon. In *printing*, a matter of first-rate importance, the ink is rubbed into the lines and superfluous ink *wiped* from the surface of the plate, ink being left in any place where a tint is required. Impressions may then be taken by hand; but a press is generally used, being more expeditious and yielding more even results. The papers used are various, but those of Japanese make are most popular. The number of good impressions possible from one plate is limited by the wearing of the plate; in particular, the burr of dry-point soon disappears. A *state* is the name given to each stage in the progress of a print, which is the result of new work on the plate. Differences due to variations in the amount of ink used, or to wiping, do not constitute states; but the addition of a title, artist's signature, &c., will make a state. As distinct from the engraved line, the etched line has a freedom and spontaneity resembling that made by pen or pencil.

The process was apparently used as a means of decorating metal some time before prints were taken. The earliest-known etching is dated 1513. Among the first to use the process was Albrecht Dürer (1471-1528), who between 1515 and 1518 produced six plates on iron, showing great power and precision, but hardly realizing all the qualities of the medium. Among his followers, the German Little Masters, Hans Sebald Beham and Albrecht Altdorfer were responsible for some interesting plates, as was Lucas van Leyden (1494-1533), the Dutchman. Among the earliest Italian etchers were Francesco Mazzuoli (1503-40) and Andrea Schiavone (1522-82), who show more freedom and delicacy than the Germans. But at this time etching was mainly the by-product of artists whose chief work was painting or engraving. Its great period opened in the seventeenth century. Jacques Callot (1592-1635), born at Nancy, who worked there and at Rome, produced about one thousand plates of small size, the most important being two series of the *Miseries of War*. He is remarkable for his fine sense of design, the fantastic, grotesque quality of his figures, and the delicacy and

variety of his line, obtained by rebiting and by combining engraving with etching. Claude Lorrain (1600-82), the landscape painter, possibly under the influence of Callot, produced some fifty plates, very delicately etched, and suggestive of atmosphere. Sir Anthony Van Dyck (1590-1641), beside being court painter to Charles I of England, was the greatest Flemish etcher of his day. His eighteen etched portraits of famous contemporaries (fifteen of which were included in his *Iconography*, published 1645), in their direct handling and vivid characterization, are among the finest work of the kind ever done. But the central figure in etching, not only of the seventeenth century but of all time, is Rembrandt van Ryn (1606-69), whose work is unrivalled both in quality and influence. His etchings show the same realism, understanding of humanity, and creative imagination which mark all his work. Roughly, they fall into three groups, according to the time at which they were produced. In the first period, the ordinary etched line is mainly used, and the artist is evidently feeling his way; in the second, chiaroscuro is more marked, and dry-point used freely; in the third, the handling is very free and vigorous, chiaroscuro becomes the dominant feature, and dry-point the usual method. Development on these lines marks all his plates, which consist of (1) portraits, e.g. *Jan Six* (c. 1640) and *Clement de Jonghe* (1651); (2) figure compositions, many of scriptural subjects, which include the masterpiece *Christ receiving Little Children* (c. 1650), commonly known as 'The Hundred Guilder Print'; (3) landscapes, e.g. *The Goldsmeiter's Field*, the least numerous class, but one which has inspired the greatest mass of work. The Dutch painters contemporary with or following Rembrandt were in some cases prolific etchers, notably Ferdinand Bol and Adrian van Ostade, and reproduce in that medium the characteristics of their painting. In the eighteenth century etching fell somewhat into disuse, save in Italy, where G. B. Tiepolo (1696-1770), the decorative painter, produced some fifty plates, and Antonio Canale (Cannetto, 1697-1768) showed in his few etchings the same power to express structure and aerial perspective as in his painting. More prolific was G. B. Piranesi (1720-88), who published a series of views of the Classical and Renaissance architecture of Rome, professedly with an archaeological aim, but of great artistic interest. His imaginative power, bold design, and vigorous handling are best seen in the fantastic plates of his *Carceri*. In England, William Hogarth (1697-1764) produced a few etchings; Thomas Rowlandson (1756-1827), the caricaturist, used etching as the basis of his aquatints; and John Crome (1768-1821), the landscape painter, etched

some characteristic plates. But it was Francisco Goya (1746-1828) whose work ushered in a new era. His bitterly satirical *Caprichos* (1793-6, 72 plates), *Proverbios* (1810-5, 18 plates), *Desastres de la Guerra* (c. 1810, 82 plates), and the more popular but no less remarkable *Tauro-maquia* (c. 1815, 83 plates illustrating bull-fighting), in all of which the bitten line is allied with aquatint, show a powerful and fantastic imagination, brilliant design and draughtsmanship, and superb technique. Widely different in character are the 71 plates of the *Liber Studio-rum*, one of the most remarkable works of J. M. W. Turner (1775-1851). In these etching merely provides the ground plan for the use of mezzotint, or, more rarely, aquatint. In the nineteenth century the revival inaugurated by Goya was carried on in France by several of the Barbizon group of landscape painters, notably by J. F. Millet (1814-75), responsible for some simple but impressive plates. A more important figure as an etcher is Alphonse Legros (1837-1911), whose admirable portraits recall those of Van Dyck, though elsewhere he shows something of Goya's taste for the grotesque. This last also appears in the work of Charles Méryon (1821-68), one of the greatest of French etchers, whose feeling for decorative design and decisive handling are best seen in his views of Paris. Apart from other etchers of the period are Jules Jacquemart and Félix Braquemond, remarkable for their exquisite delicacy in the reproduction of surface texture. Of the Impressionist painters, Camille Pissarro (1830-1903) produced some very individual plates, marked by the use of broken lines and much rebiting, in the effort to secure atmospheric effect. Similarly, by means of open shading and absence of outline, Anders Zorn (1860-1918), the Swede, has aimed at reproducing the play of light round objects; but his portraits are his best work. The chief figure in nineteenth-century etching, however, is J. A. M'N. Whistler (1834-1903), whose *French Set* (1858), *Thames Set* (1871), *Venice Set* (1880), and *Twenty-six Etchings* (1886) show his delicate yet decisive handling, his economy of means, his feeling for design, and his power of securing luminosity and atmosphere. Part of his success was due to insistence upon printing his own plates. His brother-in-law, Sir Francis Seymour Haden (1818-1910), the distinguished doctor, also took a prominent part in the revival of etching, and in his plates showed remarkable skill. The same accomplishment marks the work of William Strang, A.R.A. (died 1921), who has produced many notable portraits of contemporary celebrities, including R. L. Stevenson and Thomas Hardy. Another artist of great technical skill, excelling in the use of dry-point, is Félicien Rops (1833-98), a Belgian, whose



work is remarkable for its union of satire and licentiousness. The most notable living etchers are chiefly found in England, and include Sir Frank Short, famous also for his mezzotints; D. Y. Cameron, a disciple of Whistler, though of marked individuality in his treatment of architecture; Murrhead Bone, whose architectural work is unrivalled and has inspired many followers; James M'Beay; and Augustus John, who stands apart from his contemporaries in his preference for figure subjects. In France, Jean-Louis Forain has produced some remarkable work, notably series dealing with the life of Christ, and with Lourdes, which show his satiric power and a very distinctive technique. See *Engraving*. —BIBLIOGRAPHY: A. M. Hind, *A Short History of Engraving and Etching* (very complete and authoritative). For technical details, M. Lalanne, *Etching*; Putou, *Etching and Mezzotint Engraving*.

**Ete'ocles** and **Polyni'ces**, two heroes of ancient Greek legend, sons of Œdipus, King of Thebes. After their father's banishment from Thebes, Eteocles usurped the throne to the exclusion of his brother, an act which led to an expedition of Polynices and six others against Thebes. This war is known as the Seven against Thebes, and forms the basis of Æschylus's *The Seven against Thebes*. The two brothers fell by each other's hand. See *Antigone*.

**Ete'sian Winds** (Gr. *etos*, year), winds which, blowing over the Mediterranean regions from a general northerly direction during some weeks of the summer, replace the heated air that rises from the Sahara and other parts of Africa. By carrying with them moisture from the sea, they add greatly to the fertility of Egypt.

**Ethane**, ( $C_2H_6$ ), a hydrocarbon belonging to the paraffin series. It is a colourless inflammable gas, and is found amongst the gaseous constituents of the Pennsylvanian oil-wells.

**Eth'elbert**, King of Kent, born about A.D. 500, died 616. He succeeded his father, Hermenric, and reduced all the English states, except Northumberland, to the condition of his dependents. Ethelbert married Bertha, the daughter of Caribert, King of Paris, and a Christian princess, an event which led indirectly to the introduction of Christianity into England by St. Augustine. Ethelbert was the first English king to draw up a code of laws.

**Ethelbert**, King of England, son of Ethelwulf, succeeded to the government of the eastern side of the kingdom in A.D. 837, and in 860, on the death of his brother Ethelbald, became sole king. His reign was much disturbed by the inroads of the Danes. He died in 866.

**Eth'elred I**, King of England, son of Ethelwulf, succeeded his brother Ethelbert in A.D. 866. The Danes became so formidable in his reign as to threaten the conquest of the whole kingdom.

Ethelred died in consequence of a wound received in an action with the Danes in 871, and was succeeded by his brother Alfred.

**Ethelred II**, King of England, son of Edgar, born A.D. 968, succeeded his brother, Edward the Martyr, in 978, and, for his want of vigour and capacity, was surnamed *the Unready*. In his reign began the practice of buying off the Danes by presents of money. After repeated payments of tribute, he effected, in 1002, a massacre of the Danes; but this led to Sweyn gathering a large force together and carrying fire and sword through the country. They were again bribed to depart; but, upon a new invasion, Sweyn obliged the nobles to swear allegiance to him as King of England; while Ethelred, in 1013, fled to Normandy. On the death of Sweyn he was invited to resume the government, and died at London in the midst of his struggle with Canute (1016).

**Eth'elwulf**, King of England, succeeded his father, Egbert, about A.D. 837, died 857. His reign was in great measure occupied in repelling Danish incursions; but he is best remembered for his donation to the clergy, which is often quoted as the origin of the system of tithes. Alfred the Great was the youngest of his five children.

**Eth'endun**, **Battle of**, the victory which Alfred the Great gained over the Danes (878), and which led to the treaty with Guthrum, the Danish king of East England. The locality is doubtful.

**Ether**, or **Æther**, sometimes called *luminiferous ether* to prevent confusion with the well-known volatile liquid of the same name, a hypothetical medium filling the whole of what seems to be empty space, and even the interstices between the atoms of material bodies. Most thinkers believe that such a medium must be postulated if we are to explain the transmission of physical actions between bodies at a distance from one another. With the exception of ordinary mechanical pressures and tensions, the simplest examples of influences that can pass across space are sound and light. Sound, we know, is carried by the air, a medium more subtle than solid or liquid bodies, but still easily recognizable by its effects on our senses, and by its mechanical, physical, and chemical properties. We know a good deal about air, and about the process that goes on when sound is passing through it. But the ether is incomparably more elusive than air. It affects the sense of sight, indeed, as the air affects the sense of hearing; but, so far as we know, it has no weight, no specific heat, no chemical affinity. Except that it is the medium which conveys light, electric and magnetic actions, and possibly gravitation, we know extremely little about it. An extreme school of modern physicists is even inclined to deny, or at least to ignore, its existence altogether.

Early speculators regarded the ether as a species of fluid, which could be displaced by ordinary matter, so that upholders of the wave theory of light necessarily thought of waves like those of sound, in which the direction of vibration is in the line of transmission, for no other kind of wave can occur in a fluid. Young and Fresnel, however, insisted on the view that the movements of the medium are at right angles to the direction of propagation, and pointed out that this might be explained by supposing the medium to possess elasticity of shape. The obvious objection to the conception of a solid which permits the planets to move through it with apparently perfect freedom was met long afterwards by Stokes and Kelvin, who instanced such substances as shoemaker's wax and jelly, which are rigid enough to be capable of elastic vibration, and yet permit bodies to pass through them with more or less ease. Fresnel's work called attention to the subject of the elasticity of bodies, and led to the discovery of the general equations of vibration of an elastic solid by Navier in 1821. Navier's equations, slightly generalized, were used by Cauchy with a certain amount of success to explain reflection, refraction, and the phenomena of crystal-optics. In 1837 George Green published a variety of elastic solid theory which was a decided improvement on Cauchy's, but many difficulties remained, and it is now almost universally agreed that the vibrations of an ordinary elastic solid do not furnish an exact parallel to the vibrations which constitute light. One of the chief difficulties is that in an ordinary elastic solid two types of waves can occur, one distortional, with the displacement of a particle perpendicular to the direction of transmission, and the other dilatational, with the displacement along the line of transmission, as in sound. Waves of light must be of the distortional kind, and the velocity of the other kind of wave may be quite different from the velocity of light. A kind of ether in which this difficulty of the longitudinal wave does not occur was imagined by Cauchy and afterwards discussed by Lord Kelvin, who called it the contractile, or labile, ether. This is an elastic body with negative compressibility, like homogeneous foam which is prevented from collapsing by attachment to the sides of a containing vessel. Another type of quasi-elastic solid was brought forward by James MacCullagh in 1839. MacCullagh's solid possesses what may be called elasticity of rotation, but offers no resistance to deformations in which elementary parts of the solid preserve their orientation. The equations of motion of this ether devised by MacCullagh are very similar to those obtained much later from a very different physical point of view by Clerk Maxwell. Elastic solid theories,

however, have fallen into the background before the advancing popularity of the electromagnetic theory of James Clerk Maxwell. Maxwell's equations of the electromagnetic field are deduced from easily demonstrable experimental facts, supplemented by the characteristic hypothesis that the electric current always travels in a closed circuit, even in cases where, as in the discharge of a condenser, the material circuit is open, so that the path of the current has to be completed through the ether. Other essential features of Maxwell's view are that electric, magnetic, and electromagnetic action is transmitted by means of stresses in a medium which possesses some sort of elasticity and inertia not exactly of an ordinary mechanical kind, and that the energy of all such action resides in the medium. 'Maxwell's equations', especially as modified by H. A. Lorentz so as to take account of the atomic structure of electricity, are fundamental in modern electrodynamics and the electron theory of matter. The form of Maxwell's equations shows that electromagnetic action can be propagated in waves with a definite velocity, which depends on the specific inductive capacity and the magnetic permeability of the medium. Maxwell had no difficulty in showing from experimental data that the velocity given by his theory, which turns out to depend on the ratio of the electrostatic and electromagnetic units of charge, is identical with the known velocity of light. He concludes that waves of light are electric waves. The actual production of waves by electrical means was experimentally demonstrated by Sir Oliver Lodge, and more completely by Heinrich Hertz, and is now a commonplace of wireless telegraphy and telephony. The question of the nature of the mechanical process by which physical actions are carried on in the ether weighed heavily on Maxwell, as on other nineteenth-century physicists. Mechanical models of many kinds have been devised to represent ethereal action. Were it sufficient for the purpose, certainly nothing could be simpler than the elastic solid model. Other models of much interest are the gyrostatic ether and the vortex sponge ether of Lord Kelvin, and the molecular vortex ether of Maxwell. It is recorded that the celebrated mathematician Gauss had made out a theory of electrodynamics, but always declined to publish it because he was unable to devise a mental picture of the physical action represented by his mathematics; and it was probably a similar reason that led Lord Kelvin to declare, so late as 1904, that "the electromagnetic theory has not helped us hitherto". Sir J. J. Thomson has developed a theory of moving tubes of electric force, which produce magnetic fields by their motion. Possibly light may consist of tremors in these tubes, and if the tubes are

discrete, it may become practicable to reconcile the modern quantum theory (q.v.) with the phenomena of interference of light, with which at present it seems to be utterly inconsistent.

The extraordinary developments in both theoretical and experimental physics during recent years have diverted attention to some extent from the question of the constitution of the ether, and the problem of its mode of working is more frequently considered from a mathematical and pseudo-metaphysical point of view than from the old standpoint of Newtonian dynamics. It was from a question about the ether, however, that the theory of relativity, the most important of recent speculations, took its origin. Is the ether fixed, or does it move? Is it carried along with the earth in its motion round the sun, or does the ether pass through the atoms of material bodies as the sea passes through the meshes of a net? The elastic solid analogy, and the simplicity of the classical explanation of the aberration of light, are evidence in favour of a fixed ether. But the celebrated interference experiment of Michelson and Morley, which was capable of detecting a comparatively small relative velocity of earth and ether, gave a null result. Various electrical experiments also point to the conclusion that the medium in which optical and electrical effects take place is carried along with the earth in its motion. We are thus placed in a dilemma. We must either reconcile the idea of a fixed ether with the Michelson-Morley and kindred experiments, or we must explain aberration on the supposition that earth and ether move together. Both alternatives have had their supporters. Those who, like Sir Joseph Larmor and Sir Oliver Lodge, believe in a fixed ether rely on the hypothesis of the 'Fitzgerald contraction', according to which bodies moving through the ether with velocity  $v$  are contracted in the direction of their motion by the fraction  $\sqrt{1 - v^2/c^2}$  of their length,  $c$  being the velocity of light. This contraction is in ordinary cases very small, amounting only to a few inches for the diameter of the earth when moving round the sun. The hypothesis follows naturally enough from the accepted theory of the motion of electrons, and leads to a perfectly simple explanation of the Michelson-Morley result. The most prominent champion of a moving ether was Sir George Stokes. He assumed that, so far as the earth's motion through it is concerned, the ether behaves as a perfect liquid, so that it moves along with the earth, and he proved that aberration would be unaffected by this motion, provided it is everywhere irrotational, or free from spin. Stokes's theory has been extended by Larmor so as to cover a very important set of phenomena found by Arago and Airy, and explained in a

general way by Fresnel. These phenomena relate to the velocity of light in material media which are in motion relative to the earth, running water for example. Fresnel proved that all the experimental results are explained if the velocity of light in the water, with respect to the earth, is given by the formula  $c' + v(1 - 1/m^2)$ , where  $c'$  is the velocity of light in still water,  $v$  is the velocity of the water relative to the earth, and  $m$  is the index of refraction of water. At present the fashionable view of all the phenomena is that taken in Einstein's theory of relativity (q.v.), which makes revolutionary suppositions with respect to the measurement of space and time, and assumes that the velocity of light is a universal constant, independent of the motion either of the source of light or of the observer. Once its initial assumptions are granted, the theory undoubtedly gives simple and natural explanations of the chief optical and electrical phenomena, and in particular leads at once to Fresnel's formula given above. Most English writers on the subject, among whom A. S. Eddington, E. Cunningham, and A. N. Whitehead are prominent, continue to believe that aether exists, in spite of the fact that as relativists they hold that no experiment can ever enable us to determine our motion through it. —BIBLIOGRAPHY: E. T. Whittaker, *History of the Theories of Aether and Electricity*; Sir Joseph Larmor, *Aether and Matter*; A. S. Eddington, *Space, Time, and Gravitation*; O. W. Richardson, *Electron Theory of Matter*; R. W. Wood, *Physical Optics*.

Ether, or Ethyl Ether,  $(C_2H_5)_2O$ , a colourless, inflammable liquid produced by distillation of alcohol with concentrated sulphuric acid. It is almost immiscible with water, lighter than alcohol, has a sweet taste, and evaporates rapidly in air, producing extreme cold. The vapour of ether mixed with air forms an explosive mixture. Ether is a valuable solvent for many organic substances, fats, oils, &c., and is also used in surgery as an anæsthetic.

Etherege (eth'c-rej), Sir George, English writer of comedy, born about 1635, died about 1691. He studied at Cambridge, travelled afterwards on the Continent, and then returned to enter himself at one of the Inns of Court. Devoting himself less to legal studies than to literature and society, he wrote several plays. In 1664 he had his first comedy represented, *The Comical Revenge, or, Love in a Tub*, which was well received. Four years later his *She Would if She Could* appeared, a brilliant play, though frivolous and immoral. Eight years afterwards (1676) he produced his best comedy, *The Man of Mode, or Sir Fopling Flutter*. Etherege's plays are witty and sparkling, and the characters, genuine portraits of the men and women he saw, are vividly if lightly drawn.

**Ethical Culture.** It has been said by a prominent leader of the movement for ethical culture that the one logma admitted is the doctrine of personaliti. The movement eliminates from its teaching all hitherto received religions, admits no Christian symbolism, and acknowledges neither a personal Creator nor a personal Saviour. Christ is, however, highly revered as a man. The world as it *should* be is regarded not as an unattainable though beautiful ideal to be admired and longed for, but as a possible reality to be achieved by strenuous concerted action. The means by which it is hoped to bring about this much-to-be-desired result is the reaction on each other of carefully selected and highly cultivated personalities. Such virtues, therefore, as kindness, pity, justice, charity, temperance, and chastity are deemed less necessary as a personal moral duty in each human being than as a means by which a perfect world may be attained. Man's duty is towards no divine being, but to his fellow-man. In place of that help from above which theologians deem needful to attain even a short step<sup>4</sup> the direction of perfection, the power of conscience is considered as sufficient for all needs, and disciples are counselled that they should

More strictly, then, the inward judge obey,

since they no longer believe in divine anger or approval.

Germs of the movement may be found in many writers, and Emerson seems to have foreseen it when he said: "The mind of this age has fallen away from theology to morals. I conceive it to be an advance." But the obvious founder of ethical societies was Felix Adler (born 1851), who, in 1876, established in New York a Society of Ethical Culture. He also set in motion such useful work as training-schools, kindergartens, and nursing. In 1885 his associate, W. Salter, established the Chicago Ethical Society. Both have written extensively on the subject; while English supporters of the movement include Sir Leslie Stephen, Sir J. Seeley, Professor Sidgwick, and others. Several ethical societies exist in Britain, carrying out much educational and philanthropic work. There are both Sunday services and Sunday schools, and in many cases the branches are more or less closely affiliated with labour and its associations. With regard to this community of work and aim, it may be noted that while ethical culturists look forward to a time when no man shall exploit his fellow human beings for personal ends, absolute equality for all is not promised, being recognized as impossible.—**BIBLIOGRAPHY:** Felix Adler, *Creed and Deed*; W. M. Salter, *Ethical Religion*.

**Eth'ics**, otherwise called *Moral Philosophy* or *Morals*, is the science which treats of the nature and laws of the actions of intelligent beings, considered as to whether they are *right* or *wrong*, *good* or *bad*. Its subject-matter is human conduct and character in view of a standard or ideal. It refers to constant elements in human nature, and, like aesthetics and logic, is of universal application. The science is more or less closely connected with theology, psychology, politics, political economy, and jurisprudence, but what most strictly belongs to it is the investigation of the principles and basis of duty or the moral law, and an inquiry into the nature and origin of the faculty by which duty is recognized. Various answers have been given to the question why we call an action good or bad, such as that it is consistent or not with the will of God, or with the nature of things, or with the greatest happiness of the greatest number, or that an inward faculty decides it to be such or such; and a great variety of *ethical* systems has been proposed. The foundations of the leading systems were laid in antiquity, the names of Socrates, Plato, Aristotle, Epicurus, the Cynics, and the Stoics being especially prominent. All the Greek philosophers, however, considered ethics from an individualistic standpoint, and paid little attention either to politics or to sociology. The introduction of Christianity brought a new element into ethical speculation, and among Christians ethics were intimately associated with theology, and morality was regarded as based on and regulated by a definite code contained in the sacred writings. The speculations of the Greeks were not, however, disregarded, and some of the ablest Christian moralists (as Augustine, Peter Lombard, Eriugena, Anselm, and Aquinas) endeavoured to harmonize the Greek theories with the Christian dogmatics. Most modern ethical systems consider the subject as apart from theology and as based on independent philosophical principles, and they fall into one of two great classes—the utilitarian systems, which recognize as the chief good, happiness, or the greatest possible satisfaction of the tendencies of our nature; and the rationalistic systems, which recognize that ideas of law and obligation can have their source only in reason. *Utilitarianism* has been rightly called universal hedonism, as distinguished from the hedonism of Epicurus, which was egoistic. The first of the modern Utilitarian school in England was Hobbes (1588-1679). Among subsequent names are those of Cadworth, Locke, Clarke, Shaftesbury, Butler, Hutcheson, Hume, Adam Smith, Reid, Paley, Whewell, Bentham, J. S. Mill, &c. Paley held that men ought to act so as to further the greatest possible happiness of the race, because God wills the happiness of

men, and rewards and punishes them according to their actions, the divine commands being ascertained from Scripture and the light of nature. Bentham's utilitarianism is considerably different from Paley's. It was entirely dissociated from theology or Scripture, and maintained that increase of happiness ought to be the sole object of the moralist and legislator, pleasure and pain being the sole test of actions. To utilitarianism as a special development belong the later 'evolution ethics' represented by Herbert Spencer, in which biological conceptions, such as 'the preservation of the human race', take the place of the Benthamite criterion for determining what is good and bad in actions. Another theory of ethics places the moral principle in the sentimental part of our nature, that is, in the direct sympathetic pleasure or sympathetic indignation we have with the impulses which prompt to action or expression. By means of this theory, which he treats as an original and inexplicable fact in human nature, Adam Smith explains all the phenomena of the moral consciousness. In considering the ethical systems of the Rationalistic school, systems which recognize that the ideas of law and obligation can have their source only in reason, the question, what is the source of the laws by which reason governs, gives rise to a number of psychological theories, amongst which we may notice Clarke's view of the moral principles as rational intuitions or axioms analogous to those of mathematics; Butler's theory of the natural authority of conscience; the position of Reid, Stewart, and other members of the later Intuitionist school, who conceive a moral faculty implanted in man which not only perceives the 'rightness' or 'moral obligation' of actions, but also impels the will to perform what is seen to be right. Very similar, as far as classification goes, is the position of Kant, who holds that reason recognizes the immediate obligation of certain kinds of conduct, and that an action is only good when done from a good motive, and that this motive must be essentially different from a natural inclination of any kind.—BIBLIOGRAPHY: H. Sidgwick, *The Method of Ethics*; A. C. Bradley, *Ethical Studies*; H. Spencer, *Principles of Ethics*; L. Stephen, *The Science of Ethics*; *The English Utilitarians*; W. Wundt, *Ethics*; J. Martineau, *Types of Ethical Theory*; A. Sutherland, *The Origin and Growth of the Moral Instinct*; E. Westermarck, *The Origin and Development of Moral Ideas*; W. R. Sorley, *The Moral Life*; C. Read, *Natural and Social Morality*.

**Ethiopia**, or **Æthiopia** (Heb. *Cush*), in ancient geography, the country lying to the south of Egypt, and comprehending the modern Nubia, Kordofan, Abyssinia, and other adjacent districts; but its limits were not clearly defined.

It was vaguely spoken of in Greek and Roman accounts as the land of the *Ichthyophagi* or fish-eaters, the *Macrobi* or long-livers, the *Troglydites* or dwellers in caves, and of the *Pygmies* or dwarf races. In ancient times its history was closely connected with that of Egypt, and about the eighth century B.C. it imposed a dynasty on Lower Egypt, and acquired a predominant influence in the valley of the Nile. In sacred history Ethiopia is repeatedly mentioned as a powerful military kingdom (see particularly *Is.* xx, 5). In the sixth century B.C. the Persian Cambyzes invaded Ethiopia; but the country maintained its independence till it became tributary to the Romans in the reign of Augustus. Subsequently Ethiopia came to be the designation of the country now known as Abyssinia (q.v.), and the Abyssinian monarchs still call themselves rulers of Ethiopia.

**Ethiopian Language**, The, or more accurately the *Geez* language, is the old official and ecclesiastical language of Abyssinia, introduced into that kingdom by settlers from South Arabia. In the fourteenth century it was supplanted as the language of the Christian Church of Abyssinia by the Amharic. It is a Semitic language resembling Aramaic and Hebrew as well as Arabic. It has a Christian literature of some importance. The principal work is a translation of the Bible, including the Old and New Testaments and *Apocrypha*, to which are appended some non-canonical writings, such as the *Shepherd of Hermas* and the *Book of Enoch*. The language is to some extent represented by the modern dialects of Tigre, and by that spoken by some nomadic tribes of the Sudan. For the Ethiopian or Abyssinian Church, see *Abyssinia* and *Copt*.

**Eth'moid Bone** (Gr. *ēthmoidea*, like a sieve), a light spongy bone situated in the upper part of the cavity of the nose. The olfactory nerves pass upward through its numerous perforations to reach the brain.

**Ethnology** and **Ethnography**, sciences dealing with man, the aim of the former being to analyse and interpret the meaning of the social phenomena of mankind, as shown in their customs, languages, institutions, &c., the latter being more concerned with descriptive details and the orderly collection of facts relating to particular tribes and localities. Both terms, however, are used very loosely and in a variety of ways, often being confused with *anthropology*, the general science or natural history of mankind, of which the other two are parts. Anthropology, again, is sometimes used in the narrower sense implied in the word *somatology*, the study of the physical structure and distinctive characteristics of the various races of mankind. When the term ethnology is used by the politician or

journalist, in most cases it is intended to refer to the racial components in a given territory; in other words, it is used in the sense in which the scientific writer would employ the word anthropology. For instance, when the endeavour was made in the earlier part of the nineteenth century to liberate the Greeks from Turkish dominion, the plea was put forward that they differed in race; and the delimitation of the territory of the Greek state was claimed on what was called 'the ethnological basis', the geographical distribution of people of Greek nationality. Even since then, and especially during the European War and the subsequent attempt at a settlement, claims have been put forward to fix the boundaries of Italy, Yugoslavia, Czechoslovakia, Poland, &c., on the basis of race and nationality. But further confusion arises from the attempt to apply this anthropological or ethnological test in deciding whether physical type, language, religion, or social traditions and usages are to be the test of nationality. In this article it will be convenient to give the term ethnology its widest meaning, and to consider not merely the customs, beliefs, and institutions of various peoples, but also the early history of the human family, its differentiation into races and the significance of their geographical distribution, and the different phases of culture which are found in the various communities even of the same race.

During the last eighty years the discovery of a series of fossilized remains of extinct genera and species of the human family and of apes has given us a glimpse of the origin and early history of mankind. Man's ancestors probably parted company with those of the anthropoid apes somewhere in the neighbourhood of Northern India early in the Miocene period; and before the close of the Pliocene period their descendants had gradually acquired the highly developed brain and the intelligence which imply the emergence of the distinctively human characteristics. The most significant token of the attainment of the status of men was the acquisition of the power of speech, which enabled its possessors to hand on the accumulated knowledge and the fruits of experience, and so enormously to increase their powers. The earliest-known representative of the human family was the Ape-man, *Pithecanthropus*, who at the end of the Pliocene period wandered east as far as Java, where the fossilized remains of a skull were found thirty years ago by Professor Eugen Dubois. At a later date a much more highly developed type, one, moreover, that was much closer to the ancestry of modern men than the aberrant Ape-man of Java, wandered as far west as England, where a representative of this extinct genus was discovered by the late Mr.

Charles Dawson in 1912 at Piltdown, in Sussex. This very primitive member of the human family has been called the 'Dawn-man' or *Eoanthropus* by Dr. Smith Woodward. He has a brain which, though poorly developed, is definitely human, but his face (and especially the jaws) retains considerable resemblance to that of an ape. Of the other fossilized remains of extinct varieties of the human family, the most important are those known respectively as Heidelberg man and Neanderthal man. The former is almost as old as the Piltdown man, and its former existence was revealed by the discovery in the Mauer Sands, near Heidelberg, in 1908, of a very massive and chinless jaw. At a much later date Europe was inhabited by a brutal species of mankind, Neanderthal man, which became extinct when in the



The Piltdown Skull

As restored by Dr. Smith Woodward and Mr. Frank O'Harlow. The dark portions are those actually recovered.

Neolithic Age men of our own species made their way into Europe and completely superseded the less efficient Neanderthal species. The latter were men of vast strength, with short, clumsy, thick-set limbs, a stooping gait, thick neck, and a great flattened head with a coarse face. These people inhabited Europe in the days when the elephant and the woolly rhinoceros lived there; they made the rough stone implements known as Mousterian. But, in spite of their enormous strength, these people were not able to hold their own in competition with the nimbler wits and the more skilled hands of *Homo sapiens*, who introduced into Europe a more finished technique in making implements, and revealed his genius and manual dexterity in the remarkable pictures which he painted on the walls of caves, especially in Southern France and Northern Spain. We have no information concerning the place of origin or the course of the wanderings of these earliest members of our own species.

But an extremely primitive race has survived until the present time to demonstrate the original type of *Homo sapiens*. The aboriginal Australian, like all existing races of men, belongs to the same species as ourselves, but it represents with singularly little modification the original type and colouring of *Homo sapiens*. Fossilized remains of the proto-Australian race have been found in Queensland (at Talgai) and in Java (at Wadjak); but the wandering of the race from its original Asiatic centre of characterization

is indicated by the survival of remnants of this people in the pre-Dravidian jungle tribes of India (mainly in the Deccan), the Vedda of Ceylon, the Sakai of the Malay Peninsula, the Toulia of Celebes, and other peoples of the Malay Archipelago, whose existence blazes the track from India to Australia.

The Australian race is on the average about 5 feet 2 inches in height; their skin is dark-brown or black; hair black and wavy or curly; skull typically long (dolichocephalic), with a relatively small brain-case; the nose is flat and broad, and the jaws large and prominent. What lowly culture these people now possess has been mainly acquired within relatively recent times by contact with more civilized peoples.

Long after the proto-Australians separated



Australian Aborigine, from east side of Lake Eyre

from the rest of mankind and wandered east, another group wandered west, and, probably in tropical Africa, became specialized in structure to become the Negro race. The negro, like the Australian, retains many primitive characters, such as the black skin and the small brain, but in other respects, such, for example, as the extremely flattened and curved hair ('peppercorns'), he has become highly specialized and sharply differentiated from all other varieties of mankind. At an early period in the history of the race the negro divided into two groups—a pygmy variety or Negrillo, and the ordinary tall negro. One of the branches of the pygmy stock became further specialized in structure (in the course of which the black colour of the skin was lost), and became the Bushman race which has gradually been pushed into the deserts of South Africa (see *Hottentot*).

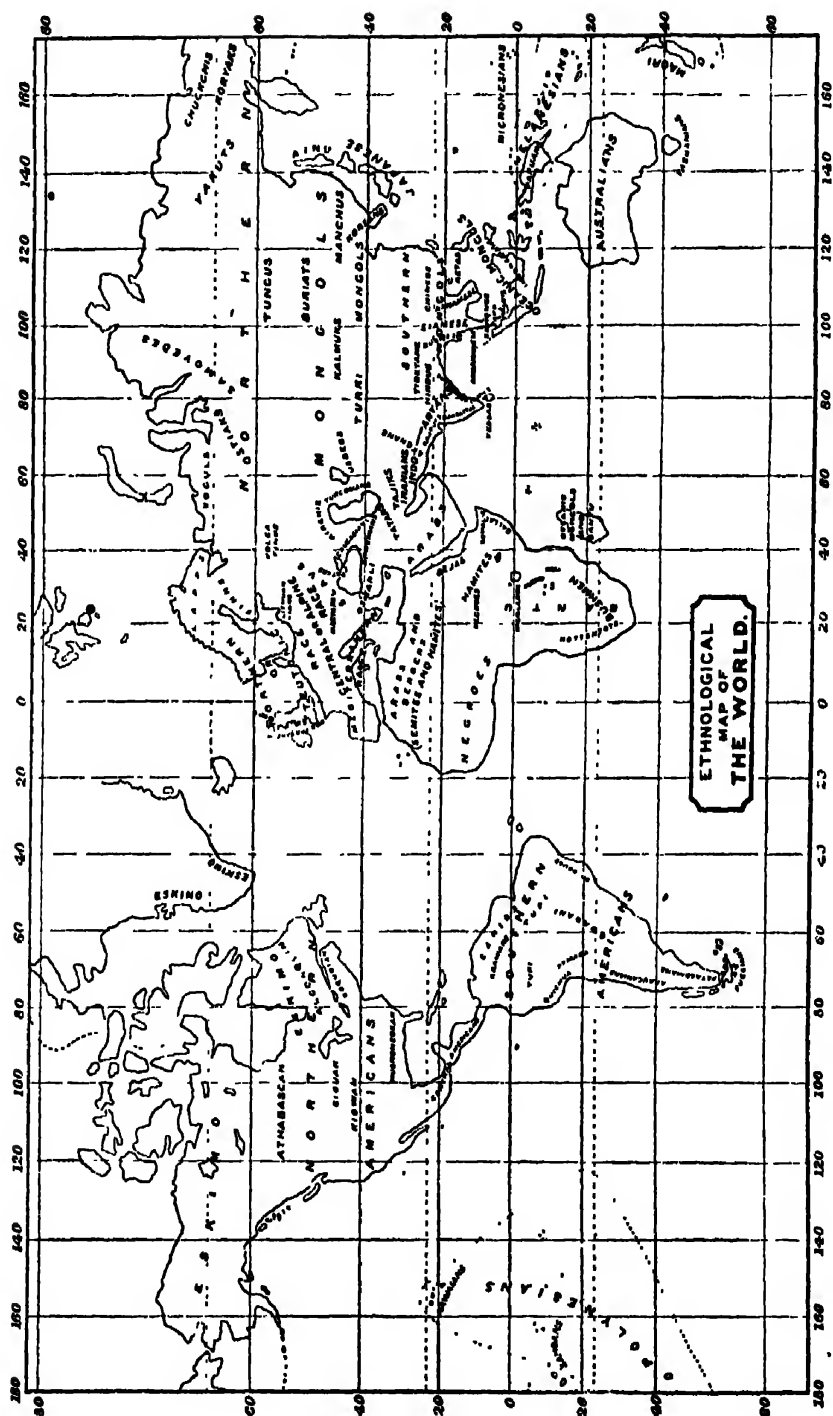
After the differentiation of the Negro race into pygmy and tall varieties, representatives of both divisions spread along the southern coast of Asia, the former, known in the East as Negritos, reaching the Andaman Islands, the Malay Peninsula (Semangs), the Philippines (Aetas), and New Guinea (Pygmies), and the taller Negroids to Melanesia, New Guinea, and the neighbouring islands of the Malay Archipelago. Many authorities regard the extinct Tasmanian people as a branch of this race.

But the vast majority of the Negro race is found in Africa south of the Sahara Desert and the populations spring from them in the American continent and the West Indies.

The African negro is subdivided into two main groups known respectively as Nilotic and Bantu; but in addition there are the pygmies of the equatorial and Congo regions, and the Bushmen and Hottentots of the Kalahari Desert, Namaqualand, Lake Ngami, and the Orange River. The Nilotic negro ranges across the continent from Somaliland to Nigeria, and is differentiated from the Bantu chiefly from the fact that along this belt there has been a constant passing to and fro of Hamitic and Semitic peoples for many centuries, leading not only to very considerable recent racial admixture, but also to cultural and especially linguistic influences, which have brought about the breaking up of the population into a series of nations of varied speech and customs. Among the Bantus, on the other hand, although their culture is lower than that of the Nilotic negroes, there is more uniformity both of race and customs. In race they are negro mixed in early times with the proto-Hamitic peoples of East Africa, whence the mongrel population moved south, driving the Bushmen and Hottentots before them.

After the ancestors of the Australian and Negro races had separated from the rest of mankind, which had spread throughout a great part of Asia, North-Eastern Africa, and Europe, the coming of the Glacial epoch created barriers of ice which shut up the various groups each within its own domain. Somewhere in Eastern Asia, possibly in the basin of the Yellow River, the proto-Mongolian race gradually assumed its characteristic traits. In East Africa and the neighbouring tract of Asia the ancestors of the Brown or so-called Mediterranean race were free to roam east and west from India to the African and European coasts of the Atlantic. Farther north, probably in Europe, the Nordic or Blond race (in the map labelled Northern or Teutonic race) assumed its distinctive features; and somewhere in the region between its area of characterization and that of the Yellow race—probably in the region to the north-east of the Caspian—the so-called Alpine (Armenoid)





or proto-Slav race developed. It is distinguished from the Brown and Blond races by the broad skull and heavy jaw, no less than by the robustness of build and the great tendency to hairiness; from the Mongolian people the Armenoids are distinguished by the prominence of the nose, the character of the hair, and the colour of the skin. The term Alpine, which is usually applied to this race, is singularly inappropriate; for, although in Europe and Asia Minor the members of this race show a partiality for high mountains, the vast majority of the members of the race dwell in the plains of Russia, which also may have been the original home of the race. In view of the topographical relationship of the area of characterization of this race to the homes of the other races, Nordic, Brown, Negro, Australian, and Mongol, arranged in a great arc around it, it might not be inappropriate to call the so-called Alpine (Armenoid or proto-Slav) race by the non-committal title 'Central'. At the close of the Glacial epoch, when the melting of the ice unlocked the domains of these races, members of the Central race poured into Asia Minor and Syria, and down to the head of the Persian Gulf; they also made their way north of the Caspian and Black Sea into Europe, mingling there with the Nordic people. But they also moved east in Siberia and mingled with the proto-Mongolian race. It was soon after this event that members of the proto-Mongolian stock, possibly with some admixture of people of the Central race, wandered to North-Eastern Asia and crossed the Behring Strait to colonize America for the first time. From the north-west coast of America these immigrants in course of time made their way south and east, until eventually the whole of the New World from Hudson Bay to Cape Horn was inhabited. Many centuries afterward (especially between 300 B.C. and A.D. 1000) there was a great influx of a variety of other peoples from Polynesia and the Old World on to the Pacific coast of the Americas, which profoundly altered the physical type of the population of Central America and the Andean coast.

The members of the proto-Mongolian race who remained in Asia spread over a large area from the Arctic Ocean south to Tibet, China, Indo-China and the Malay Archipelago, the Philippines, Formosa, Nicobar Islands, and Madagascar. Their domain became divided geographically into three minor areas of characterization, of the Northern, Southern, and Oceanic Mongols respectively. In the Northern Mongols are included the Koreans, the Japanese and the people of Liu-Kiu, the Tungus (including the Manchus, Golds, &c.), the Kalmuks, Buriats, Koryaks, Chukchis, Kamchadules, Gilyaks,

The Central race became differentiated into a considerable number of varieties. Apart from the Slavs, there were several groups which became isolated the one from the other in Asia Minor and Syria. One of these developed in an extreme degree the characteristic features of the race—the brachycephaly, the prominence of the nose and the high-narrow of the jaw. These are the Armenian and kindred people. 'Another branch gave origin to the Northern Semites, who made their way into Palestine and Mesopotamia. (The Southern Semites belong to another race—the Brown.) Another branch of the Central race preceded these two in making their way to the sea-coasts of the Levant and the Persian Gulf—this may be called the Maritime branch of the Central race.

The Slav branch of the Central race was making its way into Europe long before the Neolithic phase of culture there. It passed north of the Black Sea via Poland. But at the end of the Neolithic phase there were two streams of other branches of the race—the true Alpine subdivision passing from Anatolia into the Cypriots and the Alps, to Switzerland, Bavaria, Savoy, and Brittany, and the Maritime division passing round the coasts to the Iberian Peninsula, the British Isles, and Western Europe.

The Brown race spread in East Africa from Somaliland to the Mediterranean and all its coasts, to Western Europe, and the British Isles; in the other direction to Arabia, the shores of the Persian Gulf, and eastward along the coast to India, where it mingled with the pre-Dravidian (proto-Australian) population to give rise to the mongrel Dravidian people. The spread of these Brown people farther east into the Malay Archipelago explains the origin of the Indonesians, who occupied the islands before the coming south of the Mongols, but after the proto-Australians and the proto-Negroids had passed through towards Australia and Melanesia respectively.

From very early times there has been an intermingling of the different races. In East Africa every degree of intermingling of the Hamitic branch of the Brown race has been taking place for more than sixty centuries with negroes, both of the Sudanese and the Bantu stocks. At a later time Arabs poured into Africa and added their quota to the mixture. In India the original pre-Dravidian (proto-Australian) aborigines became diluted with a large influx of the Brown race to form the Dravidian people, who acquired a high civilization from the west. At a later date people of the Central race speaking an Aryan language swarmed through the north-western frontier and introduced their language and culture into India.

Before this happened the Brown race had

extended farther east and provided the basis for the population of Indonesia, supplanting to a great extent the earlier proto-Australian and Negroid peoples there. Then the Malays came down from the north and added to the Indonesian mixture a strong Mongolian element. Colonists from the Malay Archipelago settled in Madagascar and added to its mixture of Brown (Semites and Hamites) and Black (Bantu) elements representatives of the Mongolian (Malay) race. In the course of their maritime expeditions the Malay Archipelago gave to Japan a not inconsiderable contribution both of people and culture.

But the area of the most complex admixture of races in ancient times was Siberia. With the melting of the ice barriers at the close of the Glacial epoch the proto-Mongolian and proto-Central peoples came into intimate contact; and to this mixture was added a proto-Nordic element, as well as a not inconsiderable influx of members of the Brown race, who came from the south through Turkestan to exploit the gold and copper of the Yenesei region. The presence of their dolichocephalic skulls in a region where brachycephaly is the rule has been a perpetual puzzle to anthropologists, who at the present time attempt to solve the problem by assuming the presence of an aboriginal race of long-headed people, who were exterminated by the Mongols and the Turks. The greed for the riches of the head-waters of the Yenesei has made Siberia the home of strife for fifty centuries. This has led not only to a puzzling admixture of races in the affected area, but has started raids of Mongols and Turks, which at various times extended as far as Europe (Huns and Avars), India, and China. So mixed are the races in Siberia that it is not easy to determine whether some of them should be classed as mainly Turki or mainly Mongol; and this applies also to the colonies (Bulgars, Magyars, Finns, Lapps, &c.) which at various times the Asiatic invaders left behind them in Europe, each of which has been profoundly altered by admixture since then.

In the great Mongolian domain that occupies so great a part of Northern and Eastern Asia there are certain definitely alien elements. The Yakuts (of the region near the Lena River) are definitely Turki in race, and the curious hairy Ainu (of Yezo, Sakhalin, and some of the Kurile Islands) are certainly members of the Central race.

A peculiar branch of the northern Mongols is clearly differentiated from the rest to form the Eskimo people who occupy Greenland and Arctic America. They present a marked contrast to the American Indians. The American Indian may be regarded essentially as a branch of the

proto-Mongolian race mixed to some extent with a proto-Central element. But on the Pacific littoral there has been considerable admixture with a variety of peoples from Eastern Asia and Oceania for several centuries (c. 300 B.C. to A.D. 1000). Although the peoples conform on the whole to a definite type as regards the characters of their hair and features, there is a considerable range of variation as regards height, skull-form, and other racial features. The people of the states where a high civilization prevailed ten centuries ago (Mexico, Central America, Peru, and Chile) are clearly differentiated from the rest of the American population by the more obtrusive evidence of admixture with Polynesian and Asiatic peoples. In addition to the peoples of the north-west coast (Haidas and Salish) and of the ancient civilizations (Mayas and Aztecs) of Central America and Mexico, the population of North America can be divided (see map) into the following tribes: (1) Athabascan, (2) Algonquin, (3) Iroquoian, (4) Siouan, (5) Shoshonean (in the map called 'Kiowan'), (6) Muskogean, and (7) Pueblo (not indicated in the map, but in Arizona, north of Mexico).

In South America the centre of the ancient civilization was in the region of the Quichua (Inca) and Aymara peoples. The semi-civilized Chibcha people occupied the table-land of Bogota. To the south of Peru the coastal people (Araucanians) were to some extent influenced by the more highly civilized Incas to their north. The presence of gold in the Matto Grosso region of Brazil attracted men from Peru, and set in motion migrations of people towards the Rio de la Plata in the south and towards Venezuela in the north. Among the linguistically distinct peoples found in the latter area are the Tupi, Arawaks, and Caribs. A very primitive people, the Botocudo, occupy the eastern coast of Brazil south of the River San Francisco.

From the beginning man was a maker of implements of stone and bone; but for a vast number of centuries he was merely a hunter who did not attempt anything more in the way of industry. Civilization probably originated in the Nile Valley when men found barley growing there naturally, and discovered that it provided them with a supply of food which could maintain them throughout the year. When the population in the valley increased, so that the natural supply of barley became inadequate, men learned to imitate the inundation, and by scraping channels in the sand to render the desert fertile. Thus was agriculture and irrigation invented, and thus were men led to organize the labour of the community under the direction of a leader who was primarily an irrigation engineer, but eventually became a king

and the god Osiris, the dead king, whose reputation as the bestower of life-giving water became apotheosized as the giver of life and immortality.

Pottery was probably invented as an outcome of the mode of life and the needs of these early agriculturists, and the domestication of cattle and the use of their milk for food helped to neutralize the ill-effects of a too exclusively cereal diet. Other events followed in the train of this first adoption of a settled mode of life. The disposal of the dead in the sands that fringed the area of cultivation, and the natural preservation of the corpse that often resulted, shaped the beliefs of the people with reference to the fate of the dead. Incidentally it led to the invention of the arts of the carpenter, the stonemason, and the embalmer; and as an outcome of these practices architecture, as well as the ritual of the temple, had its origin.

Long before these events primitive man had begun to ponder over the meaning of death. At first he associated it with such injuries as he had learned by experience killed animals that he hunted; and as the escape of blood caused unconsciousness and death, he framed the belief that blood was the substance of consciousness and of life. To exchange blood was to share knowledge; to give blood was to confer fresh vital substance, i.e. to minimize the risk of extinction or prolong the existence of living or dead. This is the fundamental idea underlying all religious belief and ritual—the giving of life and immortality.

But the act of birth is also a process of life-giving. The cowrie-shell (and subsequently other shells and the pearls contained in them) came to be regarded as a symbol of this life-giving power, and an amulet which could protect both the living and the dead from the risk of extinction. The demand for these precious elixirs of life became so intense that they acquired a fictitious value as currency, and models of them were made to serve as amulets in their stead. The beauty and the lightness of the models of such shells made of the soft useless plastic metal found in the Egyptian and Nubian deserts was probably the means by which gold first acquired any value, and afterwards by confusion came to be credited with the same life-giving attributes as were at first bestowed merely upon the form of the amulets made from it. Thus gold came to be regarded as an elixir of life, and men began to search for the precious substance far and wide, incidentally spreading abroad the germs of the arts and crafts, the beliefs and practices of our common civilization. The use of malachite as a cosmetic provided the circumstances that eventually led men to discover how a gold-like substance, copper, could

be obtained from the green ore; and in course of time it came to be realized that the metal was useful for other purposes than the mere making of amulets and jewellery. When the full value of copper as a material for making tools and weapons was fully appreciated, the ore became of tremendous economic importance, and men sought for it far and wide, as they had previously prospected for flint and gold.

The people who introduced the Neolithic culture into Europe brought with them from Egypt a knowledge of agriculture, of pottery-making, of domestication of animals, of linen, and of the characteristic burial customs and religious beliefs. But these rudiments of civilization were also diffused to Crete and Cyprus, to Syria and Asia Minor, to Elam and Sumer by prospectors searching for the things which the growth of civilization was making valuable, the incense and the timber, the gold and precious stones, the copper and other metals. It is probable that the germs of Egyptian civilization were first planted in Elam by men prospecting for copper, and that Sumerian and Babylonian civilization received their initial inspiration in this way. Crete was inoculated with the germs of civilization by Egypt directly, as well as indirectly, from Asia Minor, which was subjected to the double influence of Egyptian and Sumerian culture. In the Age of Copper, Elamite culture was diffused abroad by miners to Turkestan and Baluchistan, thence respectively to Siberia and China (Shensi province), and to India. In the neighbourhood of the south-eastern corner of the Caspian the alloy bronze was probably invented soon after 3000 B.C. by mixing tin and copper; and the influence of this epoch-making event rapidly spread to Babylonia, to Crete, and to Europe, where it inaugurated the Age of Bronze. It also spread to China, to India, and many centuries later across the Pacific to Central America.

The needs of the early Egyptians compelled them to devise sea-going ships, which in turn became the models of the Cretans, the people of East Africa, the Babylonians, the Phœnicians, and the Greeks. These ships trafficked in the Eastern Mediterranean and the Red Sea, then farther west and east, to the Atlantic seaboard of Western Europe and the shores of the Indian Ocean. The search for gold and pearls led early mariners to Southern India and Ceylon, to Sumatra and Indonesia, to the whole coast-line of Eastern Asia, New Guinea, and Melanesia, and in course of time to Polynesia and the coasts of Central America and Peru. Wherever these adventurers found gold or copper, pearls or precious stones, they settled to exploit these sources of wealth, and incidentally planted the

germs of their methods of cultivation, their stonework, their burial customs and beliefs. Such expeditions were probably responsible for introducing into Polynesia its first colonists, a mixture of people of Brown and Maritime Central races, mingled with other elements in the course of their easterly wanderings. The earliest movement into Polynesia apparently took with it a considerable element of Melanesian blood, which eventually was carried to New Zealand and the Moriori Islands in the south, and to Easter Island and the American coast in the east. The germs of the ancient civilizations of Central America and Peru were carried across the Pacific from Cambodia and Indonesia between the years 300 B.C. and A.D. 1000, the periods of greatest activity being probably the third and fourth centuries A.D.

The elements of this imported culture were planted in Honduras and Guatemala and the Isthmus region (Costa Rica, Panama, and Colombia), and from there spread in the fifth century A.D. to Yucatan and then to Mexico. It also spread from the isthmus down the Pacific littoral of South America, the earliest centre of civilization being the region around Lake Titicaca. From Mexico the culture spread in a degraded form up the Mississippi to the Great Lakes, as well as north-west into Arizona. BIBLIOGRAPHY: A. H. Keane, *Man, Past and Present*, revised edition by A. Huxton Quiggin and A. C. Haddon, is a useful guide to the literature of anthropology and ethnology; see also Robert Munro, *Prehistoric Britain*; W. J. Sollas, *Ancient Hunters and their Modern Representatives*; M. Bonie, *Les Hommes fossiles*; G. Elliot Smith, *The Migrations of Early Culture*; such periodicals as the *Journal of the Royal Anthropological Institute*, *Man*, and especially *L'anthropologue*, give the current literature.

Eth'yl, the name given to the radicle  $C_2H_5$ , contained in ether,  $(C_2H_5)_2O$ , alcohol,  $C_2H_5OH$ , &c. Ethyl has not been isolated, as it immediately combines with another ethyl group forming diethyl or butane,  $C_2H_5-C_2H_5$ . Ethyl chloride,  $C_2H_5Cl$ , formed by the action of hydrochloric acid on alcohol, is much used for the production of low temperature—as a local anæsthetic. Ethyl nitrite,  $C_2H_5NO_2$ , constitutes sweet spirits of nitre when dissolved in alcohol.

Eth'ylamine,  $C_2H_5NH_2$ , an organic base formed by the substitution of 1 atom of hydrogen in ammonia by ethyl group. Thus



ethylamine. It has the odour and many of the characteristic reactions of ammonia, but unlike

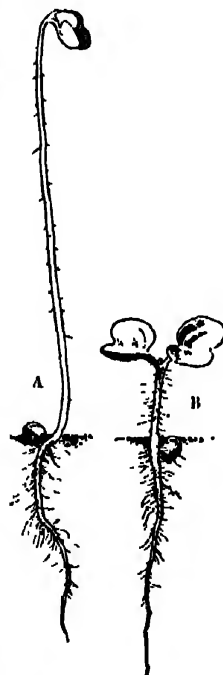
ammonia it is inflammable and liquid at ordinary temperature.

Eth'ylene, or Olefant Gas,  $C_2H_4$ , an unsaturated hydrocarbon, the first member of the olefine series. It is a colourless gas with a faint odour, and burns with a bright luminous flame. It is a constituent of ordinary coal-gas, and may be obtained from alcohol by heating it with twice its volume of concentrated sulphuric acid.

Étienne (â-ti-ân), St., a town of Southern France, department of Loire, on the Furens, 32 miles S.W. of Lyons. It has spacious streets with substantial houses, but, owing to the number of public works, presents a dingy appearance. The principal buildings and institutions are the cathedral, an ancient Romanesque structure; the town house, court-house, exchange, communal college, mining school, gallery of arts, library, and museum. The town stands in the centre of one of the most valuable mineral fields of France; and in addition to the extensive collieries, blast-furnaces, and other ironworks in the vicinity, has manufactures of ribbons, silks, cutlery, and fire-arms. Pop. 148,656.

Etiolation (Fr. *étioier*, to blanch), or Blanching, of plants, is a state produced by the absence of light, by which the green colour is prevented from appearing. It is effected artificially, as in the case of celery, by raising up the earth about the stalks of the plants; by tying the leaves together to keep the inner ones from the light; by covering with pots, boxes, or the like, or by setting in a dark place. The green colour of etiolated plants may be re-

stored by exposure to light. Etiolated plants are also abnormal in other respects; the stems, or in some cases the leaves, become extraordinarily elongated, and the internal structure undergoes modification in various ways.



Two Seedlings of *Sinapis alba* of Equal Age

A, Grown in the dark, etiolated. B, Grown in ordinary daylight, normal. The roots bear root-hairs.

**Etymology** (Gr. *aitia*, cause, and *logos*, discourse, account), a biological term introduced by Huxley, and denoting that branch of biology which deals with the origin and mode of development of organic beings. In medicine the word *etiology*, signifies the study of the causes and origin of disease. The term is also applied in philosophy to the science of Cause and Effect.

**Etive** (et'iv), Loch, an inlet of the sea on the west coast of Scotland, Argyleshire, nearly 20 miles long, of very unequal breadth, but at the broadest part about  $1\frac{1}{2}$  miles. The scenery of its shores is very beautiful. About 3 miles from the sea, at Connel Ferry, a ridge of sunken rocks crossing it causes a turbulent rapid, which at half-tide forms a sort of waterfall.

**Etna, or Ætna, Mount**, the greatest volcano in Europe, a mountain in the province of Catania in Sicily; height, 10,758 feet. It rises immediately from the sea, has a circumference of more than 100 miles, and dominates the whole north-east part of Sicily, having a number of towns and villages on its lower slopes. The top is covered with perpetual snow; midway down is the woody or forest region; at the foot is a region of orchards, vineyards, olive groves, &c. Etna thus presents the variety of climates common to high mountains in lower latitudes, oranges and lemons and other fruits growing at the foot, the vine rather higher up, then oaks, chestnuts, beeches, and pines, while on the loftiest or desert region vegetation is of quite a stunted character. A more or less distinct margin of cliff separates the mountain proper from the surrounding plain; and the whole mass seems formed of a series of superimposed mountains, the terminal volcano being surrounded by a number of cones, all of volcanic origin, and nearly 100 of which are of considerable size. The different aspects of the mountain present an astonishing variety of features—woods, forests, pastures, cultivated fields, bare rocky precipices, streams of lava, mounds of ashes and scorie, as also picturesque towns and villages. From the summit the view presents a splendid panorama, embracing the whole of Sicily, the Lipari Islands, Malta, and Calabria. The eruptions of Etna have been numerous, and many of them destructive. That of 1180 overwhelmed Catania and buried 15,000 persons in the ruins. In 1680 the lava spread over the country for forty days, and 10,000 persons are estimated to have perished. In 1693 there was an earthquake during the eruption, when over 60,000 lives were lost. One eruption was in 1755, the year of the Lisbon earthquake. There were also eruptions in 1832, 1865, 1874, 1879, and 1886. Among more recent eruptions are those of 1892, 1899, 1911, and 1914. An eruption is ordinarily preceded by premonitory symptoms of longer

or shorter duration. The population of the district of Etna is about 300,000.

**E'ton**, a town of England, in Buckinghamshire, on the left bank of the Thames, 22 miles west of London. An iron bridge connects it with Windsor, on the opposite side of the river. Eton derives its celebrity wholly from its college, called the King's College of Our Lady of Eton beside Windsor, one of the great public schools of England, founded by Henry VI in 1440. The building, which was commenced in 1441 and finished in 1528, has received important additions in recent times in the shape of mathematical and science schools, and a museum. The college foundation now consists of provost, headmaster, lower master, seventy scholars, and two conductors (or chaplains). The oppidans, or boys not on the foundation, number about 1100. They are mostly lodged and boarded in the masters' houses. Pop. 3366.

**Etrépilly**, (1) a small town of France, department of Aisne, is situated near Châtiau-Thierry. Millstones are obtained from quarries in the neighbourhood. (2) A small town of France, department of Seine-et-Marne, stands on the left bank of an affluent of the Marne. Agricultural implements are manufactured.

**Etru'ria** (Gr. *Tyrrhēnia*), the name anciently given to that part of Italy which corresponded partly with the modern Tuscany, and was bounded by the Mediterranean, the Apennines, the River Magna, and the Tiber. The name of Tusci or Etrusci was used by the Romans to designate the race of people anciently inhabiting this country, but the name by which they called themselves was Rasena (or perhaps more correctly *Tu-rasena*). These Rasena entered Italy at a very early period from the north, and, besides occupying Etruria proper, extended their influence to Campania, Elba, and Corsica. Etruria proper was in a flourishing condition before the foundation of Rome, 753 B.C. It was known very early as a confederation of twelve great cities, each of which formed a republic by itself. Amongst the chief were Veii, Clusium, Volturni, Arretium, Cortona, Falerii, and Faesulæ; but the list may have varied at different epochs. The chiefs of these republics were styled *lucumōnes*, and united the office of priest and general. They were elected for life. After a long struggle with Rome, the Etruscan power was completely broken by the Romans in a series of victories, from the fall of Veii in 396 B.C. to the battle at the Vadimonian Lake (283 B.C.). The Etruscans had attained a high state of civilization. They carried on a flourishing commerce, and at one time were powerful at sea. They were less warlike than most of the nations around them, and had the custom of hiring mercenaries for their armies. Of the Etruscan language little is known,

although about 6000 inscriptions have been preserved. It was written in characters essentially the same as the ancient Greek. The Etruscans were specially distinguished by their religious institutions and ceremonies, which reveal tendencies gloomy and mystical. Their gods were of two orders, the first nameless, mysterious deities, exercising a controlling influence in the background on the lower order of gods, who manage the affairs of the world. At the head of these is a deity resembling the Roman Jupiter (in Etruscan *Tinia*). But it is characteristic of the Etruscan religion that there is also a Vejovis or evil Jupiter. The Etruscan name of Venus was *Turan*, of Vulcan *Sethlans*, of Bacchus *Phuphluns*, of Mercury *Turms*. Etruscan art was in the main borrowed from Greece. For articles in terra-cotta, a material which they used mainly for ornamental tiles, sarcophagi, and statues, Etruscans were especially celebrated. In the manufacture of pottery they had made great advances; but most of the painted vases popularly known as Etruscan are undoubtedly productions of Greek workmen. The skill of the Etruscans in works of metal is attested by ancient writers, and also by numerous extant specimens, such as necklaces, earrings, and bracelets. The bronze candelabra, of which many examples have been preserved, were eagerly sought after both in Greece and Rome. A peculiar manufacture was that of engraved bronze mirrors. These were polished on one side, and have on the other an engraved design, taken in most cases from Greek legend or mythology. The Etruscans showed great constructive and engineering skill. They were acquainted with the principle of the arch, and the massive ruins of the walls of their ancient cities still testify to the solidity of their constructions. Various arts and inventions were derived by the Romans from the Etruscans. — BIBLIOGRAPHY: G. Dennis, *Cities and Cemeteries in Etruria*; Seymour, *Up Hill and Down Dale in Ancient Etruria*.

**Etruria**, a village of England, in Staffordshire, between Hanley and Burslem, famous as the place where Josiah Wedgwood established his pottery works in 1700. Pop. 8036.

**Etruria, Kingdom of**, in Italy, founded by Napoleon I in 1801. Its capital was Florence. In 1807 Napoleon incorporated it with the French Empire.

**Etruscan Vases**, a class of beautiful ancient painted vases made in Etruria, but not strictly speaking a product of Etruscan art, since they were really the productions of a ripe age of Greek art, the workmanship, subjects, style, and inscriptions being all Greek. They are elegant in form and enriched with bands of beautiful foliage and other ornaments, figures and similar

subjects of a highly artistic character. One class has black figures and ornaments on a red ground—the natural colour of the clay; another has the figures left of the natural colour and the ground painted black. The former class belong to a date about 600 B.C., the latter date about a century later, and extend over a period of about 300 or 350 years, when the manufacture seems to have ceased. During this period there was much variety in the form and ornamentation, gold and other colours besides the primitive ones of black and red being frequently made use of. The subjects represented upon these vases frequently relate to heroic personages of the Greek mythology, but many scenes of an ordinary and even of a domestic character are



Etruscan Pottery (from Ven)

depicted. The figures are usually in profile; temples are occasionally introduced; and many curious particulars may be learned from these vase pictures regarding the Hellenic ritual, games, festivities, and domestic life.

**Ettrick**, a pastoral district of Scotland, in Selkirkshire, watered by the Ettrick, and anciently part of Ettrick Forest, which included Selkirk with parts of Peebles and Edinburgh. The Ettrick receives the Yarrow 2 miles above Selkirk, and enters the Tweed 3 miles below. The *Ettrick Shepherd*, the Scottish poet James Hogg, was a native of this district.

**Etty**, William, an English painter, born in 1787, died in 1840. He studied at the Royal Academy, worked long without much recognition, but at length in 1820 he won public notice by his *Coral Fishers*. In 1828 he was elected an academician. Among his works, which were greatly admired, are a series of three pictures (1827-31) illustrating the *Deliverance of Belshazzar by Judith*, *Benaiah* (one of David's mighty men), and *Women Interceding for the Vanquished*. All these are very large pictures, and are now in the National Gallery of Scotland (Edinburgh). Others of note are: *The Judgment of Paris*; *The*



*Rape of Proserpine*; and *Youth at the Prow*, and *Pleasure at the Helm*. Kitty especially excelled at painting undraped figures.

**Etymology** (Gr. *etymos*, true, and *logos*, account), a term applied (1) to that part of grammar which treats of the various inflections and modifications of words and shows how they are formed from simple roots; (2) to that branch of philology which traces the history of words from their origin to their latest form and meaning. Etymology in this latter sense, or the investigation of the origin and growth of words, is amongst the oldest of studies. Plato and other Greek philosophers, the Alexandrian grammarians, the scholasts, the Roman Varro, and others wrote much on this subject. Their work, however, is made up of conjectures at best ingenious rather than sound, and very often wild and fantastic. It was not till recent times, and particularly since the study of Sanskrit, that etymology has been scientifically studied. Languages then began to be properly classed in groups and families, and words were studied by a comparison of their growth and relationship in different languages. It was recognized that the development of language is not an arbitrary or accidental matter, but proceeds according to general laws. The result was a great advance in etymological knowledge and the formation of a new science of *philology*.—Cf. W. W. Skeat, *The Science of Etymology*.

**Eu** (*eu*), a town in Northern France, department of Seine-Inférieure, about 17 miles north-east of Dieppe. It is notable for its old twelfth-century church and the celebrated Château d'Eu, part of which was destroyed in 1902. Pop. 4000.

**Eubœa**, formerly called Negropont, a Greek island, the second largest island of the Aegean Sea. It is 90 miles in length; 30 in greatest breadth, reduced at one point to 4 miles. It is separated from the mainland of Greece by the narrow channels of Egripo and Talanta. It is connected with the Boeotian shore by a bridge. There are several mountain peaks over 2000 feet in height, and one over 7000 feet. The island is well-wooded and remarkably fertile. Wine is a staple product, and cotton, wool, pitch, and turpentine are exported. The chief towns are Chaleis and Karysto. The island was anciently divided among seven independent cities, the most important of which were Chaleis and Eretria, and its history is for the most part identical with that of those two cities. With some small islands it forms a modern nomarchy, with a pop. of 110,890.

**Eubulus**, a Greek comic poet, who flourished at Athens about 375 B.C. His subjects were chiefly mythological, and he delighted in ridiculing the tragic poets, especially Euripides.

**Eucalyptus**, a genus of trees, nat. ord.

Myrtaceæ, mostly natives of Australia, and remarkable for their gigantic size, some of them attaining the height of 480 or 500 feet. In the Australian colonies they are known by the name of gum trees, from the gum which exudes from their trunks; individual species are known as 'stringy bark', 'iron bark', *karri*, or *jarrah*. The wood of some is excellent for building and many purposes. The *E. globulus*, or blue gum, yields an essential oil which is valuable as a febrifuge, antasthmatic, and antispasmodic. The medicinal properties of this tree also make it



*Eucalyptus globulus*

1, Section of unopened flower 2, Anther  
3, Section of fruit

useful as a disinfectant, and as an astringent in affections of the respiratory passages, being employed in the form of an infusion, a decoction, or an extract, and cigarettes made of the leaves being also smoked. The *E. globulus* and the *E. amygdalina* are found to have an excellent sanitary effect when planted in malarious districts such as the Roman Campagna, parts of which have already been reclaimed by their use. This result is partly brought about by the drainage of the soil (the trees absorbing great quantities of moisture), partly perhaps by the balsamic odour given out. *E. mannifera* and others yield a sweet secretion resembling manna. Some, especially *E. rostrata*, yield a kind of gum kino. The *Eucalyptus* has been introduced with success into India, Palestine, Algiers, and Southern France.

**Eucharist** (û'ku-rîst; Gr. *eucharistia*, from *eu*, well, and *charis*, grace), a name for the sacrament of the Lord's Supper, in reference to the blessing and thanksgiving which accompany it.

**Eucharistic Congresses**, gatherings of the Roman Catholic clergy and laity, held with the object of glorifying the Sacrament of the Eucharist, were inaugurated by Bishop de Sègur, of Lille. The first congress, held in that city (1881) excited little but local interest; but the movement rapidly developed, succeeding congresses being held at Avignon (1882), Liège (1883), Paris (1888), Jerusalem (1893), Lourdes (1899), Rome (1905), and elsewhere. In 1908 the congress held in London was attended by Cardinal Vannutelli, the first Papal legate to visit England for three centuries, by six other cardinals, fourteen archbishops, and seventy bishops. A proposal to carry the Sacrament through London in procession aroused much opposition, and the project was abandoned on the personal intervention of Mr. Asquith, then Premier.

**Euchre** (û'ker), a card-game very popular in America, is usually played by two or four persons. After the cut for deal five cards are dealt (either by twos and threes or by threes and twos) to each player, and the uppermost card of those undealt is turned up for trump. The first player has the option either to 'order up' (namely to make this card trump) or to pass. In the latter case it is left to the next player to decide if he will play first or pass, and so on till the turn of the dealer comes. He must either play on this trump or turn it down, when all the players have again in turn their choice of making a new trump or passing. If a trump is 'ordered up' or taken in the first round, the dealer may take it into his cards, discarding in its place his poorest card. If the player who elects to play wins five tricks, he counts two; if he wins three tricks, he counts one; if he wins fewer than three tricks, he is *euchred*, and each independent opponent counts two. The cards rank as at whist, except that the knave of the trump suit, called the *right bower* (from the Ger. *bauer*, a peasant), is the highest card, the knave of the other suit of the same colour being the second highest.

**Eucken**, Rudolf Christoph, German philosopher and theologian, born in East Friesland in 1840. Educated at the Universities of Göttingen and Berlin, he was professor of philosophy at Basel from 1871 to 1874, when he obtained a similar appointment at Jena. Opposed both to utilitarianism and positivism, Eucken is one of the leaders of those German philosophers who maintain that the spiritual interests of man should be taken into consideration, and oppose the philosophic systems which treat life only from the

physical and biological points of view. His spiritualistic philosophy has found many adherents, and his works are very popular. In 1908 he won the Nobel prize for literature, and in 1910 he was made a D.D. of the University of Glasgow. His works include: *The Life of the Spirit* (1909), *The Problem of Human Life as viewed by the Great Thinkers* (1909), *The Meaning and Value of Life* (1909), *Main Currents of Modern Thought* (1911), *Can we still be Christians?* (1913). He died in 1926.

**Euclid** (*Euclidēs*), of Alexandria, a distinguished Greek mathematician, who flourished about 300 B.C. His *Stoicheia* (Elements of Geometry), in thirteen books, are still extant, and form the most usual introduction to the study of geometry. The work was known to the Arabs, translations of it having appeared in the time of Harun-al-Rashid and of Al-Mamun. It was translated from the Arabic into Latin by Adelard of Bath, and an English translation from the Latin appeared in 1570. The severity and accuracy of Euclid's methods of demonstration have as a whole never been surpassed. Besides the *Elements*, some other works are attributed to Euclid. - Cf. Sir T. L. Heath, *The Thirteen Books of Euclid's Elements*.

**Euclid** (*Euclidēs*), of Megara, an ancient Greek philosopher, the founder of the Megaric school of philosophy, and a pupil of Socrates.

**Eudiometer** (Gr. *eudios*, serene), an instrument originally designed for ascertaining the purity of the air or the quantity of oxygen it contains, but now employed generally in the analysis of gaseous mixtures. It consists of a graduated glass tube, either straight or bent in the shape of the letter U, hermetically sealed at one end and open at the other. Two platinum wires, intended for the conveyance of electric sparks through any mixture of gases, are inserted through the glass near the closed end of the tube, and approach but do not touch each other. To determine the proportion of oxygen in a given specimen of air, hydrogen is introduced into the tube with a measured volume of the air, and the mixture is fired by an electric spark. Water is formed, and the quantity of oxygen can be estimated from the diminution of volume. In a mixture of gases, chemical absorbents may be used to remove the gases one by one, the amounts present being determined by the successive changes of volume.

**Eugene** (û-jên'), or François Eugène, Prince of Savoy, fifth son of Eugène Maurice, Duke of Savoy-Carignan, and Olympia Mancini, a niece of Cardinal Mazarin. He was born at Paris 18th Oct., 1663, and died in Vienna 21st April, 1736. Offended with Louis XIV, he entered the Austrian service in 1683, serving his first campaign as a volunteer against the Turks. Here

he distinguished himself so much that he received a regiment of dragoons. Later, at the sieges of Belgrade and Mayence, he increased his reputation, and on the outbreak of war between France and Austria he received the command of the Imperial forces sent to Piedmont to act in conjunction with the troops of the Duke of Savoy. At the end of the war he was sent as commander-in-chief to Hungary, where he defeated the Turks at the battle of Zenta (11th Sept., 1697). The War of the Spanish Succession brought Eugene again into the field. In Northern Italy he outmanœuvred Catinat and Villeroi, defeating the latter at Cremona (1702). In 1703 he commanded the Imperial army in Germany, and in co-operation with Marlborough frustrated the plans of France and her allies. In the battle of Blenheim, Eugene and Marlborough defeated the French and Bavarians under Marshal Tallard, 13th Aug., 1704. Next year Eugene, returning to Italy, forced the French to raise the siege of Turin, and in one month drove them out of Italy. During the following years he fought on the Rhine, took Lille, and, in conjunction with Marlborough, defeated the French at Oudenarde (1708), and Malplaquet (1709), where he himself was dangerously wounded. After the recall of Marlborough, which Eugene opposed in person at London, without success, and the defection of England from the alliance against France, his further progress was in a great measure checked. In the war with Turkey, in 1716, Eugene defeated two superior armies at Peterswarden and Temesvar, and, in 1717, took Belgrade, after having gained a decisive victory over a third army that came to its relief. During fifteen years of peace which followed, Eugene served Austria as faithfully in the Cabinet as he had done in the field. He was one of the great generals of modern times.—*CF. G. B. Malletson, Prince Eugene of Savoy.*

*Eugenia* (so named in honour of Prince Eugene), a genus of Myrtaceæ, nearly related to the myrtle. It contains numerous species, some of which produce delicious fruits. Cloves are the dried flower-buds of *E. caryophyllata*.

Eugenics has been defined as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally". It is concerned with the investigation of the physical, mental, and moral traits of mankind, and especially with the factors of inheritance of desirable and undesirable qualities. The interest in the subject is largely due to the untiring zeal of the late Sir Francis Galton, who devoted most of his life to the study of the manifold problems that came within the scope of 'eugenics', and, in accordance with the terms of his will (1908), founded the Galton Chair of Eugenics in the University

of London. The library and laboratory of the Galton benefaction form part of the Department of Applied Statistics, under the direction of Professor Karl Pearson, F.R.S., at University College, London, who is also the editor of the journal *Biometrika*, which is devoted to the statistical side of the problems of anthropology and heredity. The aim of the Galton laboratory is to collect material relating to human heredity, and to investigate its significance; and also to extend the knowledge of eugenics by professional instruction, lectures, publications, and experimental work. The scope of its activities will best be appreciated by the study of such works as the late Sir Francis Galton's *Natural Inheritance* (1889) and *Essays in Eugenics* (1909), and Professor Karl Pearson's *Groundwork of Eugenics* (1909), *Practical Problems of Eugenics* (1909), and *State of National Eugenics* (1909). *The Treasury of Human Inheritance*, issued in parts from the Galton laboratory, is a monumental record of facts relating to the hereditary transmission of human qualities. The Eugenics Education Society, under the presidency of Major Leonard Darwin, has for its aim the stimulation of public interest in the subject, and the discussion of the problems of heredity. It issues a journal, *The Eugenics Review*, now in its twelfth year.

It has long been known that by means of careful selection of parents it was possible to breed horses, cattle, dogs, &c., and a great variety of food- and flowering-plants, with desirable qualities highly developed. But it is obvious that such direct methods cannot be applied to human beings for the purpose of breeding men and women with special traits. What the eugenic societies aim at doing is to educate the people to realize the far-reaching effects of the inheritance of good or bad qualities, in the hope that such knowledge may exert some influence in the choice of partners in matrimony. But their efforts are especially directed to the exposure of the disastrous results that may ensue from the contamination of a family by the intermarriage of one of its members with an individual subject to some hereditary defect of a physical, mental, or moral nature.

The study of eugenics is intimately related to a wide range of subjects: to genetics, which explains the laws that govern the heredity of specific traits in man, and suggests certain practical applications of the rules of breeding to race improvement by cutting off undesirable strains and by selecting mates desirable from the eugenic standpoint; to the study of biographies of individuals and the genealogies of families, for the purpose of obtaining data for the investigation of the working of inheritance; to anthropology, history, and archaeology, law

and politics, economics and sociology, medicine and psychology, and statistical science.

The tremendous stimulus which the rapid development of eugenics has given to the wider recognition of the significance of heredity in human affairs has tended to obscure the importance of social environment and individual experience, especially in children of tender age, in shaping the attitude of the individual. Education is a vastly more important factor—the manner and attitude of the teacher, rather than the subject-matter of his or her lessons—than the eugenic enthusiasts, with their over-emphasis on the dominance of hereditary influences, are willing to admit. In the causation of many diseases, commonly reputed to be hereditary, such as tuberculosis and certain forms of insanity, the social and physical circumstances probably play a more important part than heredity in determining the onset of the illness, even when some undoubted hereditary aptitude to fall a victim to one or other of these affections is admitted. In no branch of medicine or sociology is this fallacy more fruitful of error than in the domain of mental disease. Apart from certain physical defects of the nervous system and specific infections, such as syphilis, the causes of mental alienation are to be sought rather in some maladjustment to the individual's social circumstances, often the result of some emotional disturbance, even in early childhood, which created the attitude of mind that eventually determined the mental conflict expressed by the insanity. The study of the effects of the strain of war has shown that anxiety, if sufficiently intense and prolonged, can produce mental disturbance in anyone, whatever his heredity and antecedents. By over-emphasizing the importance of inheritance in the causation of such conditions as insanity and epilepsy, and ignoring the effects of the profound social disturbance an insane parent may inflict upon any home, and especially upon the impressionable minds of young children in it, the eugenic societies have been responsible for raising up a growing body of opposition to their views. Not only in the domains of medicine and psychology, but also in those of ethnology and sociology, there is a feeling that the eugenic claims have been pushed too far. But when the subject of eugenics has been pruned of these extravagances, it will exert a far-reaching influence upon social and political organization and events by compelling respect for the vast importance of heredity as a factor that plays some part in determining the physical, mental, and moral qualities of mankind. References to the voluminous literature will be found in *The Eugenics Review* (published by the Eugenics Education Society, Kingsway, London).

Eugénie (eu-zhà-nè), Marie de Guzman, ex-Empress of the French, born at Granada, in Spain, 5th May, 1826, died at Seville 11th July, 1920. Her father, the Count de Montijo, was of a noble Spanish family; her mother was of Scotch extraction, maiden name Kirkpatrick. On 29th Jan., 1853, she became the wife of Napoleon III and Empress of the French. On 16th March, 1850, a son was born of the marriage. When the war broke out with Germany, she was appointed regent (15th July, 1870) during the absence of the emperor, but on the 4th Sept. the Revolution forced her to flee from France. She went to England, where she was joined by the Prince Imperial and afterwards by the emperor. Camden House, Chislehurst, became the residence of the imperial exiles. On 9th Jan., 1878, the emperor died, and six years later the Prince Imperial was slain while with the British army in the Zulu War. In 1881 the empress transferred her residence to Farnborough, in Hampshire. During the European War she established a hospital at Farnborough. In 1918 she handed over to Clemenceau the letters which she had received from William I in 1870. The letters shed a striking light upon the ambitions of Prussia. She was buried in the mausoleum at Farnborough.—BIBLIOGRAPHY: De Lano, *The Empress Eugénie*; Tschuddi, *Eugène, Empress of the French*; Stoddart, *The Life of Empress Eugénie*; E. Legge, *The Empress Eugénie and her Son*.

Eugenius, the name of four Popes.—1. Eugenius I, elected 8th Sept., 654, while his predecessor, Martin I, was still living; died in 657 without having exerted any material influence on his times.—2. Eugenius II held the see from 824–827.—3. Eugenius III, born at Pisa, was a disciple of St. Bernard of Clairvaux. He was raised to the papedom in 1145; was obliged to quit Rome in 1146 in consequence of the commotions caused by Arnold of Brescia; returned with the help of King Roger of Sicily in 1150, and died in 1153.—4. Eugenius IV, from Venice, originally called Gabriel Condolmero, was raised to the papedom in 1431. In consequence of his opposition to the Council of Basel he was deposed. He died in 1447.

Eugenol, or Allylgualacol, is found in cloves, the leaves of cinnamon, and other plants. About 90 per cent of clove oil is composed of eugenol.

Eugubine Tables, the name given to seven bronze tablets or tables found in 1444 at the town of Gubbio, the ancient Iguvium or Eugubium, now in the Italian province of Perugia, bearing inscriptions in the language of the ancient Umbrians, which seems to have somewhat resembled the ancient Latin as well as the Oscan. They seem to have been inscribed three or four centuries B.C., and refer to sacrificial usages and ritual.

**Euhemerism**, a method or system (so named from its founder Euhemerus, a Greek philosopher) of interpreting myths and mythological deities, by which they are regarded as dedications of dead heroes and poetical exaggerations of real histories.

**Eulenspiegel** (oi'len-spē-gl), Till, a name which has become associated in Germany with all sorts of wild, whimsical frolics, and with many amusing stories. Some such popular hero of tradition and folk-lore seems to have really existed in Germany, probably in the first half of the fourteenth century, and a collection of popular tales of a frolicsome character, originally written in Low German, purports to contain his adventures. The earliest edition of such is a Strasbourg one of the year 1515 in the British Museum. Better known, however, is that of 1519, published also at Strasbourg by Thomas Minner (under the title *Ilavle-glass*). The work was early translated into English and almost all European tongues. A modern English translation appeared in 1800.

**Euler** (oi'ler or ū'ler), Leonard, a distinguished mathematician, born at Basel in 1707, died at St. Petersburg (Petrograd) in 1783. He was educated at the University of Basel under the Bernouillis, through whose influence he procured a place in the Academy of St. Petersburg. In 1741 he accepted an invitation from Frederick the Great to become professor of mathematics in the Berlin Academy, but in 1766 returned to St. Petersburg, where he became director of the mathematical class of the academy. Euler's profound and inventive mind gave a new form to the science. He applied the analytic method to mechanics, and greatly improved the integral and differential calculus. He also wrote on physics, and employed himself in metaphysical and philosophical speculations. Amongst his numerous writings are: the *Theoria Motuum Planetarum et Comelarum*, *Introductio in Analysin Infinitorum*, and *Opuscula Analytica*.

**Eumenes** (-nēz), the name of two kings of Pergamus.—1. Eumenes I succeeded his uncle Philetarus 263 B.C. He reigned for twenty-two years, and then died in a fit of drunkenness.—2. Eumenes II succeeded his father Attalus 197 B.C., and, like him, attached himself to the Romans, who, as a reward for his services in the war against Antiochus of Syria, bestowed upon him the Thracian Chersonesus and almost all Asia on this side of the Taurus. He died in 159 B.C.

**Eumenides** (ū-mē-nī-dēz). See *Furies*.

**Eumycetes**, or **Higher Fungi**, a common name for those Fungi which possess a septate mycelium. They also have a well-marked type of 'principal' spore—either the *ascospore* (Ascomycetes) or the *basidiospore* (Basidiomycetes)—

and rarely produce definite sexual organs. Opposed to Phycomycetes.

**Eunomians**, the followers of Eunomius, Bishop of Cyzicum, in the fourth century A.D., who held that Christ was a created being of a nature unlike that of the Father.

**Eu'nuch**, an emasculated male. The term is of Greek origin (*eunouchos*, from *eunē*, a couch or bed, *echein*, to hold or guard); but eunuchs became known to the Greeks no doubt from the practice among Eastern nations of having them as guardians of their women's apartments. Eunuchs were employed in somewhat similar duties among the Romans in the luxurious times of the empire, and under the Byzantine monarchs they were common. The Mohammedans still have them about their harems. Emasculation, when effected in early life, produces singular changes in males and assimilates them in some respects to women, causing them in particular to have the voice of a female. Hence it was not uncommon in Italy to castrate boys in order to fit them for soprano singers when adults.

**Euon'yms**, the spindle trees or prickwoods, a genus of shrubs or trees, nat. ord. *Clavicornæ*, containing about fifty species, natives of the temperate regions of the northern hemisphere. The root-bark of *E. atropurpureus* is the source of euonymin, a bitter principle with a powerful stimulating effect on the liver.

**Eupato'ria**, formerly Koslov, a seaport on the western coast of the Crimea, government of Taurida. It was here that the allied forces landed at the commencement of the Crimean War (14th to 18th Sept., 1854). Pop. 30,432.

**Eupato'rium**, a genus of plants, chiefly natives of America, belonging to the nat. ord. *Compositæ*. Their roots are perennial, possessing a rough, bitter, or aromatic taste; the flowers are small, white, reddish, or bluish, in corymbs. Amongst the many species are *E. cannabinum*, or hemp-agrimony, a British plant.

**Eupen** (oi'pen), a town and district of Belgium, formerly part of Rhenish Prussia, 7 miles S.S.W. of Aix-la-Chapelle. It has manufactures of woollen and linen cloth, hats, soap, leather, and chemicals; paper, flax, and worsted mills; and an important trade. The town was ceded to Prussia at the Peace of Paris in 1814. On 26th May, 1910, Eupen was occupied by Belgian troops, and by the Treaty of Versailles Eupen and Malmédy were handed over to Belgium. Pop. 13,540.

**Eupho'nium**, a brass bass instrument, generally introduced into military bands, and frequently met with in the orchestra as a substitute for the superseded ophicleide. It is one of the saxhorn family of instruments. It is tuned in C or in B flat, and is furnished with three or four valves or pistons.

**Euphorbia.** See *Spurge*.

**Euphorbia***ceae*, the spurge-worts, a nat. ord. of herbaceous plants, shrubs, or very large trees, which occur in all regions of the globe. Most of them have an acrid milky juice, and dielinous or monœcious flowers. The fruit is dry or slightly fleshy, and three-lobed. Among the genera are: *Euphorbia*, which yields an oil used as a powerful cathartic; *Croton*, affording croton-oil; the *Ricinus communis*, or castor-oil plant; the *Buxus sempervirens*, or box-wood plant; the *Manihot utilisima*, which yields the food known as tapioca or cassava. In most members of the genera the milky juice contains caoutchouc.

**Euphorbium**, a yellowish-white body, which is the solidified juice of certain plants of the genus *Euphorbia*, either exuding naturally or by incisions made in the bark. It is a powerfully acrid substance, virulently purgative and emetic.

**Euphrates**, or **El Frat**, a celebrated river of Western Asia, Mesopotamia, having a double source in two streams rising in the Anti-Taurus range. Its total length is about 1750 miles, and the area of its basin 260,000 sq. miles. It flows mainly in a south-easterly course through the great alluvial plains of Babylonia and Chaldaea till it falls into the Persian Gulf by several mouths, of which only one in Persian territory is navigable. About 100 miles from its mouth it is joined by the Tigris, when the united streams take the name of Shatt-el-Arab. It is navigable for about 1200 miles, but navigation is somewhat impeded by rapids and shallows. The melting of snow in the Taurus and Anti-Taurus causes a flooding in spring. The water is highest in May and June, when the current, which rarely exceeds 3 miles an hour, rises to 5. In the Bible (*Gen. xv, 18*) the Euphrates is *The River*, or *The Great River*.

**Euphuism** (Gr. *euphuos*, well endowed by nature), an affected style of speech which distinguished the conversation and writings of many of the wits of the court of Queen Elizabeth. The name and the style were derived from *Euphuus*, the *Anatomy of Wit* (about 1580), and *Euphuus and his England* (about 1582), both written by John Lyly (1554-1606). A well-known euphuist in fiction is Sir Piercie Shafton in Scott's *Monastery*. Scott, however, had not studied Lyly sufficiently, and Sir Piercie raves bombastically rather than talks euphuistically. The chief characteristics of genuine euphuism were extreme artificiality and numerous allusions to natural history embellished by imagination.

**Eu'polis**, an Athenian comic poet, who flourished about 429 B.C. Neither the date of his birth nor that of his death is known with certainty. He belongs, like Aristophanes and Cratinus, to the Old Comedy. His works are

all lost except small fragments. According to Suidas, he produced seventeen plays, seven of which won the first prize. His best-known plays are the *Kolakes* (Flatterers), in which he attacked the prodigal Callias, and the *Baptæ* (Dippers), in which he attacked Alcibiades and the exotic ritual practised at his clubs.

**Eura'sians** (syncopated from European-Asians), a name euphemistically given to the 'half-castes' of India, the offspring of European fathers and Indian mothers. They are particularly common in the three presidential capitals—Calcutta, Madras, and Bombay. Belonging strictly to neither race, Eurasians are not infrequently ostracized by both; and their anomalous position often exerts a baneful influence upon their character. They generally receive a European education, and the young men are often engaged in Government or mercantile offices. The girls, in spite of their dark tint, are generally very pretty and often marry Europeans.

**Eure** (*eur*), a river of North-West France, which rises in the department of the Orne, and falls into the Seine after a course of 124 miles, being navigable for about half the distance. It gives its name to a department in the north-west of France, forming part of Normandy; area, 2330 sq. miles. The surface consists of an extensive plain, intersected by rivers, chief of which is the Seine. It is extensively cultivated; apples, pears, plums, and cherries form important crops, and a little wine is produced. The mining and manufacturing industries are extensive, and the department has a considerable trade in woollen cloth, linen and cotton fabrics, carpets, leather, paper, glass. Evreux is the capital. Pop. 303,092.

**Eure-et-Loir** (*eur-è-lwar*), a department in the north-west of France, forming part of the old provinces of Orléannais and Ile-de-France; area, 2293 sq. miles. A ridge of no great height divides the department into a north and a south basin, traversed respectively by the Eure and the Loire. The soil is extremely fertile, and there is scarcely any waste land. A considerable portion is occupied by orchards and vineyards, but the greater part is devoted to cereal crops. The department is essentially agricultural, and has few manufactures. The capital is Chartres. Pop. 251,259.

**Eureka** (Gr. *heurēka*, I have found it), the exclamation of Archimedes when, after long study, he discovered a method of detecting the amount of alloy in King Hiero's crown. Hence the word is used as an expression of triumph at a discovery or supposed discovery.

**Eurhythmics**, a general term, but usually used to denote a system of education evolved by Émile Jacques-Dalcroze of Geneva. This form of training bears on all art, but especially on the art of music. Eurhythmics is essentially

an original contribution to education. It aims at training musical sense on the broadest lines, using the body as an instrument of expression. Breaking away from preconceived ideas of music as a phenomenon of sound only, M. Dalcroze claims that music is innate. From this standpoint it follows that musicality as such is capable of cultivation apart from instrumental performance. Rhythm, not being a quality confined to music, but found common to all art, and fundamental to life, can, therefore, be developed from within the human being. This the Dalcroze system claims to do. Rhythm of sound plays a leading part in that it is allied to movement. Exercises at the piano are played to which the pupil listens, and to which he responds in movement—movement so closely allied to the music that it is a form of musical imagery. The technique is developed on simple lines to serve this end only. The system is progressive, starting from elementary rhythmic structure, and ending with complete musical form. It is far-reaching in educative purpose. It claims to free innate rhythm, to develop it for individual self-expression; to bring mind and body into closer unity, and in their interaction to give poise to both; to train accurate musical listening, ready assimilation of musical language and its spontaneous translation into terms of movement; to give musical experiences which shall be heard and felt; to cultivate musical expression and creation (in movement); to blend self-discipline with emotion.

Euripides, the last of the three great Greek writers of tragedies, was born about 480 B.C., and died 406 B.C. Tradition declares that he was born at Salamis, on the very day of the Greek naval victory there. He was, as far as we can tell, of good birth; at any rate, he was well educated, and was able to live a life of ease and leisure, and to collect one of the largest libraries of the time. The comic poets, especially Aristophanes, delighted to say that his mother, Cleito, was a cabbage-woman, but there is probably little or no truth in this statement. Euripides was originally trained as an athlete, but conceived an intense dislike for that occupation. Greatly daring, he expressed his view openly (Fragment 284). Like a popular modern dramatist, his recreation was probably 'anything except sport'. He then took to painting, but abandoned it in favour of writing tragedies. His first play (not preserved), the *Peliades*, was produced when he was twenty-five years of age. He is said to have written ninety-two dramas, eight of which were satyr-plays. Ancient critics allow seventy-five of these to have been genuine. During his long career he only won the first prize five times. Euripides did not take any part in public life, but devoted himself entirely

to a life of speculation and to writing plays. There is a tradition, not, however, on a very firm basis, that he was twice married, and that both marriages were failures. He is represented by Aristophanes as a woman-hater, but indeed he portrays women more sympathetically than *Æschylus* or *Sophocles*. The women had little cause to congratulate themselves on securing Aristophanes as a champion, for his scorpions are far more stinging than Euripides' whips. Euripides left Athens about 400 B.C., and went to the court of King Archelaus in Macedonia. There he died in 406 B.C.; according to some accounts, he was killed by savage dogs which were set on him by some of his rivals at the king's court.

Seventeen tragedies and one satyr-play have been preserved to us. The latter (*The Cyclops*) is interesting as being the only example of a satyr-play which we possess. In itself it is not amusing. It has been admirably translated by Shelley. The seventeen tragedies in the order of their production are: *Alcestis*, *Medea*, *Hippolytus*, *Hecuba*, *Andromache*, *Ion*, *Suppliants*, *Heracleidae*, *Hercules Furens*, *Iphigenia among the Tauri*, *Trojan Women*, *Helena*, *Phenissæ*, *Electra*, *Orestes*, *Iphigenia at Aulis*, and *The Bacchæ*. The *Rhesus*, a feeble production long attributed to Euripides, is almost certainly not his work.

The work of Euripides still retains the power of arousing strong likes and dislikes. He has had sturdy supporters and fanatical detractors. The truth is that if the tragedies of *Æschylus* and *Sophocles* are looked upon as models for all Greek tragedy, Euripides falls far short of his models. Euripides, however, though he died shortly before *Sophocles*, belonged to a younger and quite different generation, and held different views about art, morality, religion, and almost everything of importance. His aim was rather different from that of the earlier poets, and he must be judged, not by their standards, but on his own merits. His own merits are amply sufficient to justify the high opinion held of him in the ancient world, and supported by many of the greatest of the moderns. The dethroning of Euripides was the result of a German conspiracy, carried out with much energy by Niebuhr, and with even more by Schlegel. They enjoyed themselves while pulling Euripides to pieces much as schoolboys who have detected a flaw in the armour of their master. Many proofs can be adduced that Euripides was not a sophistical trifler; but one glance at his bust is enough to assure anyone of unbiased judgment that he was a man of remarkable breadth of mind and intellectual gifts. The fact remains, however, that the extant plays of Euripides are of very unequal



merit. The *Helena* is not a good play; it was ridiculed by Aristophanes, but he did not succeed in making it much more absurd than it was already. The *Hecuba* and the *Heracleidae* are not well constructed, and the *Electra* and *Orestes* challenge too directly the masterpieces of the earlier tragedians. In his greatest plays, however, Euripides can bear comparison with any poet. The *Medea* is a play which still never fails to please; the *Hippolytus* and the *Ion* are admirable dramas and admirably constructed; above all, the *Bacchæ* is a masterpiece, more picturesque than any other Greek tragedy, a play not unworthy to be set near *The Tempest* and *Cymbeline*.

Euripides has been accused by his detractors of degrading his art, because he opened his plays with a prologue and ended them with the intervention of a god. Both devices, if not desirable, are quite pardonable. Possible plots were becoming more and more scarce; Euripides did not wish to adopt trite themes, and so went into the by-ways of mythology, or adopted a less well-known alternative version of a well-known legend. He could not count on his audience already possessing enough knowledge of the story to enable them to understand his plays without a prologue. The *deus ex machina*, as the god who ends some of the plays is called, was often warranted or required by the plot which called for a conventional ending. Euripides has also been accused, by Aristophanes and by many less entertaining writers, of taking away all the dignity of tragedy. It is quite true that he is a realist. Sophocles represented men as they ought to be, Euripides represented them as they were. This was an unforgivable offence in the eyes of the 'men of Marathon' at Athens. The tragic heroes were not mere stage characters, they were considered; they were often ancestors or national heroes, and it was impious to represent them as speaking ordinary language, or sharing the weaknesses of ordinary men. Euripides did do this, did it intentionally, and did it excellently. He came at an awkward transition period, and the lack of success of some of his work is owing to the impossibility of pouring new wine into old bottles. The old tragedy was too tightly bound by convention to suit Euripides, who wished to portray living men and women, and to have an exciting plot. The new comedy—the romantic comedy of Menander—had not yet been invented. Had it been, Euripides would surely have written comedies. The comic poets of the next century turned to him for a model, and it was one of them, Philemon, who said that if he were quite sure that dead men retained their perception he would hang himself to see Euripides. Euripides is, in fact, the earliest writer of romantic

plays, a fact well illustrated by his *Alcestis*, which is one of his best plays. In it tragedy and comedy are harmoniously blended, and it has a happy ending.

For better and for worse Euripides is a very modern poet, and makes a special appeal to the present generation. But his pathos, his wide sympathies, and his wonderful poetry have appealed to the best judges in all ages. Theocritus, Virgil, Ovid, Horace, Milton, and Browning have been among his admirers; his detractors include a few Teutonic professors, and a few who honour the memory of Aeschylus and Sophocles on the other side idolatry.—BIBLIOGRAPHY: A. W. Verrall, *Euripides the Rationalist*; G. G. A. Murray, *Euripides and his Age* (Home University Library); W. B. Donne, *Euripides* (Ancient Classics for English Readers); Sir J. P. Mahaffy, *Euripides: an Account of his Life and Works*; N. J. Patin, *Étude sur Euripide*; P. Masqueray, *Euripide et ses idées*. There is a complete verse translation by A. S. Way, and verse translations of several plays by G. G. A. Murray. There is a 'transcript' of the *Alcestis* in Browning's *Balaustion's Adventure*, and of the *Hercules Fureus* in his *Aristophanes' Apology*.

Euripus (ἑὺ-ρί-πους), in ancient geography, the strait between the Island of Eubœa and Boœtia in Greece.

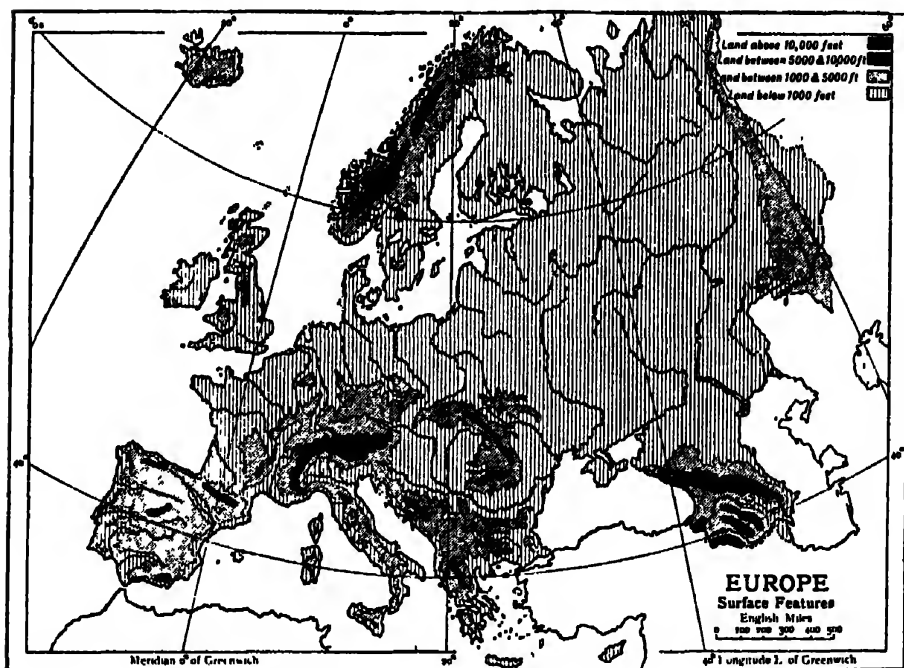
Euroclydon, a tempestuous wind of the Levant, which was the occasion of the shipwreck of the vessel in which St. Paul sailed, as narrated in *Acts*, xxvii, 14-44. The north-east wind is the wind evidently meant in the narrative; and an alternative reading adopted in the revised version is *euraclon* (euraquilo) or north-easter.

Euro'pa, in Greek mythology, the daughter of Agenor, King of the Phœnicians, and the sister of Cadmus. The fable relates that she was abducted by Jupiter, who for that occasion had assumed the form of a white bull, and swam with his prize to the Island of Crete. Here Europa bore to him Minos, Sarpedon, and Rhadamanthus.

Europe, the smallest of the great continents, but the most important in the history of civilization for the last two thousand years. It forms a huge peninsula projecting from Asia, and is bounded on the north by the Arctic Ocean; on the west by the Atlantic Ocean; on the south by the Mediterranean, the Black Sea, and the Caucasus Range; on the east by the Caspian Sea, the Ural River, and the Ural Mountains. The most northerly point on the mainland is Cape Nordkyn, in Lapland, in lat. 71° 6'; the most southerly points are Punta da Tarifa, lat. 36° N., in the Strait of Gibraltar, and Cape Matapan, lat. 36° 17', which terminates

Greece. The most westerly point is Cape Roca in Portugal, in long.  $0^{\circ} 28'$  w., while Ekaterinburg is in long.  $00^{\circ} 36'$  e. From Cape Matapan to North Cape is a direct distance of 2400 miles, from Cape St. Vincent to Ekaterinburg, north-east by east, 3400 miles; area of the continent, about 3,865,000 sq. miles. Great Britain and Ireland, Iceland, Novaya Zemlya, Corsica, Sardinia, Sicily, Malta, Crete, the Ionian and the Bulearie Islands are the chief islands of Europe. The shores are very much indented, giving Europe an immense length of coast-line (esti-

900 miles from the Polar Sea to the south point of Norway. The highest summits are about 8000 feet. The Alps, the highest mountains in Europe (unless Mount Elbruz in the Caucasus is claimed as European), extend from the Mediterranean first in a northerly and then in an easterly direction, and attain their greatest elevation in Mont Blanc (15,780 feet), Monte Rosa, and other summits. Branching off from the Alps, though not geologically connected with them, are the Apennines, which run south-east through Italy, constituting the central ridge of the penin-



mated at nearly 50,000 miles). The chief seas or arms of the sea are: the White Sea on the north; the North Sea on the west, from which branches off the great gulf or inland sea known as the Baltic; the English Channel, between England and France; the Mediterranean, communicating with the Atlantic by the Strait of Gibraltar (at one point only 19 miles wide); the Adriatic and Archipelago, branching off from the Mediterranean; and the Black Sea, connected with the Archipelago through the Hellespont, Sea of Marmora, and Bosphorus.

**Surface.**—The mountains form several distinct groups or systems of very different geological dates, the loftiest mountain masses being in the south central region. The Scandinavian mountains in the north-west, to which the great northern peninsula owes its form, extend above

sula. The highest summit is Monte Corno (9541 feet). Mount Vesuvius, the celebrated volcano in the south of the peninsula, is quite distinct from the Apennines. By south-eastern extensions the Alps are connected with the Balkan and the Despot-Dagh of the south-eastern peninsula of Europe. Among the mountains of South-Western Europe are several massive chains, the loftiest summits being in the Pyrenees, and in the Sierra Nevada in the south of the Iberian Peninsula. The highest point in the former, La Maladetta or Mount Maudit, has an elevation of 11,165 feet; Mulahacen, in the latter, is 11,703 feet, and capped by perpetual snow. West and north-west of the Alps are the Cevennes, Jura, and Vosges; north and north-east, the Harz, the Thüringerwald Mountains, the Fichtelgebirge, the Erzgebirge and Böhmerwaldgebirge. Farther

to the east the Carpathian chain encloses the great plain of Hungary, attaining an elevation of 8000 or 8500 feet. The Ural Mountains between Europe and Asia reach the height of 5540 feet. Besides Vesuvius, other two volcanoes are Etna in Sicily, and Hecla in Iceland. A great part of Northern and Eastern Europe is level. The great plain of North Europe occupies part of France, Western and Northern Belgium, Holland, the northern provinces of Germany, and the greater part of Russia. A large portion of this plain, extending through Holland and North

cluding windings 2400 miles. Into the Mediterranean flow the Ebro, the Rhône, and the Po; into the Black Sea, the Danube, Dnieper, Dniester, and Don (through the Sea of Azov); into the Atlantic, the Guadalquivir, the Guadiana, the Tagus, and Loire; into the English Channel, the Seine; into the North Sea, the Rhine, Elbe; into the Baltic, the Oder, the Vistula, and the Duna; into the Arctic Ocean, the Dvina. The lakes of Europe may be divided into two groups, the southern and the northern. The former run along both sides of the Alps, and among them,



Germany, is a low sandy level not infrequently protected from inroads of the sea only by means of strong dykes. The other great plains of Europe are the Plain of Lombardy (the most fertile district in Europe) and the Plain of Hungary. Part of Southern and South-Eastern Russia consists of steppes.

**Rivers and Lakes.**—The main European watershed runs in a winding direction from south-west to north-east, at its north-eastern extremity being of very slight elevation. From the Alps descend some of the largest of the European rivers, the Rhine, the Rhône, and the Po, while the Danube, a still greater stream, rises in the Black Forest north of the Alps. The Volga, which enters the Caspian Sea, an inland sheet without outlet, is the longest of European rivers, having a direct length of nearly 1700 miles, in-

cluding windings 2400 miles. Into the Mediterranean flow the Ebro, the Rhône, and the Po; into the Black Sea, the Danube, Dnieper, Dniester, and Don (through the Sea of Azov); into the Atlantic, the Guadalquivir, the Guadiana, the Tagus, and Loire; into the English Channel, the Seine; into the North Sea, the Rhine, Elbe; into the Baltic, the Oder, the Vistula, and the Duna; into the Arctic Ocean, the Dvina. The lakes of Europe may be divided into two groups, the southern and the northern. The former run along both sides of the Alps, and among them,

on the north side, are the lakes of Geneva, Neuchâtel, Thun, Lucerne, Zürich, and Constance; on the south side, Lago Maggiore, and the lakes of Como, Lugano, Isco, and Garda. The northern lakes extend across Sweden from west to east, and on the east side of the Baltic a number of lakes, stretching in the same direction across Finland on the borders of Russia, mark the continuation of the line of depression. It is in Russia that the largest European lakes are found—Lakes Ladoga and Onega.

**Geology.**—The geological features of Europe are exceedingly varied. The older formations prevail in the northern part as compared with the southern half and the middle region. North of the latitude of Edinburgh and Moscow there is very little of the surface of more recent origin than the strata of the Upper Jura belonging to

the Mesozoic period, and there are vast tracts occupied either by eruptive rocks or one or other of the older sedimentary formations. Denmark belongs to the Cretaceous period, as does also a large part of Russia between the Volga and the basin of the Dnieper. Middle and Eastern Germany, with Poland and the valley of the Dnieper, present on the surface Eocene formations of the Tertiary period. The remainder of Europe is remarkable for the great diversity of its superficial structure, rocks and deposits belonging to all periods being found within it, and having for the most part no great superficial extent. Europe possesses abundant stores of those minerals which are of most importance to man, such as coal and iron, Britain being particularly favoured in this respect. Coal and iron are also obtained in France, Belgium, and Germany. Gold is found to an unimportant extent, and silver is widely spread in small quantities. The richest silver ores are in Norway, Spain, the Erzgebirge, and the Harz Mountains. Spain is also rich in quicksilver. Copper ores are abundant in the Ural Mountains, Thuringia, Cornwall, and Spain. Tin ores are found in Cornwall, the Erzgebirge, and Brittany.

*Climate.*—Several circumstances concur to give Europe a climate peculiarly genial, such as its position almost wholly within the temperate zone, and the great extent of its maritime boundaries. Much benefit is also derived from the fact that its shores are exposed to the warm marine currents and warm winds from the south-west, which prevent the formation of ice on most of its northern shores. The eastern portion has a less favourable climate than the western. The extremes of temperature are greater, the summer being hotter and the winter colder, while the lines of equal mean temperature decline south as we go east. The same advantages of mild and genial temperature which western has over eastern Europe, the continent collectively has over the rest of the Old World. The diminution of mean temperature, as well as the intensity of the opposite seasons, increases as we go east. Peking, in lat. 40° N., has as severe a winter as Petrograd in lat. 60° N.

*Vegetable Productions.*—With respect to the vegetable kingdom, Europe may be divided into four zones. The first, or most northern, is that of fir and birch. The birch reaches almost to North Cape; the fir ceases a degree farther south. The cultivation of grain extends farther north than might be supposed. Barley ripens even under the seventieth parallel of north latitude; wheat ceases at 64° in Norway, 62° in Sweden. Within this zone, the southern limit of which extends from lat. 64° in Norway to lat. 62° in Russia, agriculture has little importance, its inhabitants being chiefly occupied with

the care of reindeer or cattle, and in fishing. The next zone, which may be called that of the oak and beech, and cereal produce, extends from the limit above mentioned to the forty-eighth parallel. The Alps, though beyond the limit, by reason of their elevation belong to this zone, in the moister parts of which cattle husbandry has been brought to perfection. Next we find the zone of the chestnut and vine, occupying the space between the forty-eighth parallel and the mountain chains of Southern Europe. Here the oak still flourishes, but the pine species become rarer. Rye, which characterizes the preceding zone on the continent, gives way to wheat, and in the southern portion of it to maize also. The fourth zone, comprehending the southern peninsula, is that of the olive and evergreen woods. The orange flourishes in the southern portion of it, and rice and even cotton are cultivated in some places in Italy and Spain.

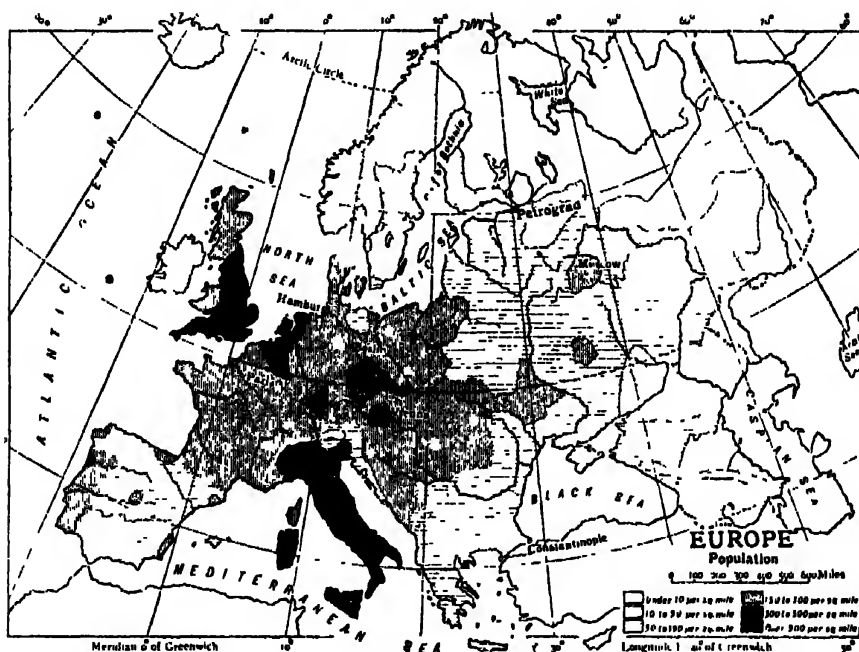
*Animals.*—As regards animals, the reindeer and polar-bears are peculiar to the north. In the forests of Poland and Lithuania the urus, a species of wild ox, is still occasionally met with. Bears and wolves still inhabit the forests and mountains; but, in general, cultivation and population have expelled wild animals. The domesticated animals are nearly the same throughout. The ass and mule lose their size and beauty north of the Pyrenees and Alps. The Mediterranean Sea has many species of fish, but no great fishery; the northern seas, on the other hand, are annually filled with countless shoals of a few species, chiefly the herring, mackerel, cod, and salmon.

*Inhabitants.*—Europe is occupied by several different peoples or races, in many parts now greatly intermingled. The Celts once possessed the west of Europe from the Alps to the British Islands. But the Celtic nationalities were broken by the wave of Roman conquest, and the succeeding invasions of the Germanic tribes completed their political ruin. At the present day the Celtic language is spoken only in the Scottish Highlands (Gaelic), in some parts of Ireland (Irish), in Wales (Cymric), and in Brittany (Armorican). Next to the Celtic comes the Teutonic race, comprehending the Germanic and Scandinavian branches. The former includes the Germans, the Dutch, and the English. The Scandinavians are divided into Danes, Swedes, and Norwegians. To the east, in general, of the Teutonic race, though sometimes mixed with it, come the Slavonians, that is, the Russians, the Poles, the Czechs or Bohemians, the Serbians, Croatians, &c. In the south and south-east of Europe are the Greek and Latin peoples, the latter comprising the Italians, French, Spanish, and Portuguese. All the above peoples are regarded as belonging to the Indo-European or

Aryan stock. To the Mongolian stock belong the Turks, Finns, Lapps, and Magyars or Hungarians, all immigrants into Europe in comparatively recent times. The Basques at the western extremity of the Pyrenees are a people whose affinities have not yet been determined. The total population of Europe is about 400 millions; nine-tenths speak the languages of the Indo-European family, the Teutonic group, the Slavonic, and the Latin. The prevailing religion is the Christian, embracing the Roman Catholic Church, which is the most numerous, the various

Spain, and Sweden. Turkey (whose possessions in Europe were limited to Constantinople) was an empire, Luxemburg was a grand-duchy, Liechtenstein and Monaco principalities whilst all the other European states were republics.

*History.*—Europe was probably first peopled 1,500 A.D., but at what date we know not. The first authentic history begins in Greece at about 776 B.C. Greek civilization was at its most flourishing period about 430 B.C. After Greece came Rome, which by the early part of the Christian era had conquered Spain, Greece,



sects of Protestants (Lutheran, Calvinistic, Anglican, Baptists, Methodists, &c.), and the Greek Church. A part of the inhabitants profess the Jewish, a part the Mohammedan religion.

*Political Divisions.*—In 1921 Europe consisted of the following independent states, kingdoms, or republics: Albania, Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Czecho-Slovakia, Denmark, Estonia, Finland, France, Georgia, Germany, Great Britain and Ireland, Greece, Hungary, Italy, Latvia, Lithuania, Luxemburg, Monaco, Montenegro, Netherlands (Holland), Norway, Poland, Portugal, Romania, Russia, Serbia (Yugo-Slavia), Spain, Sweden, Switzerland, Turkey, Ukraine. Of these the following were kingdoms: Belgium, Bulgaria, Denmark, Great Britain, Greece, Italy, Montenegro, Netherlands (Holland), Norway, Serbia (Yugo-Slavia),

Gaul, Helvetia, Germany between the Danube and the Alps, Illyria, and Dacia. Improved laws and superior arts of life spread with the Roman Empire throughout Europe, and the unity of government was also extremely favourable to the extension of Christianity. With the decline of the Roman Empire a great change in the political constitution of Europe was produced by the universal migration of the northern nations. The Ostrogoths and Lombards settled in Italy, the Franks in France, the Visigoths in Spain, and the Anglo-Saxons in South Britain, reducing the inhabitants to subjection, or becoming incorporated with them. Under Charlemagne (771–814) a great Germanic empire was established, so extensive that the kingdoms of France, Germany, Italy, Burgundy, Lorraine, and Navarre were afterwards formed out of it.

About this time the northern and eastern nations of Europe began to exert an influence in the affairs of Europe. The Slavs, or Slavonians, founded kingdoms in Bohemia, Poland, Russia, and the north of Germany; the Magyars appeared in Hungary; and the Normans agitated all Europe, founding kingdoms and principalities in England, France, Sicily, and the East. The Crusades and the growth of the Ottoman power are amongst the principal events which influenced Europe from the twelfth to the fifteenth century. The conquest of Constantinople by the Turks (1453), by driving the learned Greeks from this city, gave a new impulse to letters in Western Europe, which was carried onwards by the invention of printing and the Reformation. The discovery of America was followed by the temporary preponderance of Spain in Europe, and next of France. Subsequently Prussia and Russia gradually increased in territory and strength. The French revolution (1789) and the Napoleonic wars had a profound effect on Europe, the dissolution of the old German Empire being one of the results. The most important events in European history from the revolution of 1789 to 1914, the beginning of the European War, were: the establishment of the independence of Greece; the disappearance of Poland as a separate state; the unification of Italy under Victor Emmanuel; the Franco-German War, resulting in the consolidation of Germany into an empire under the leadership of Prussia; and the partial dismemberment of the Turkish Empire. The European War, 1914-8 (q.v.), revolutionized the continent and altered the map of Europe. The chief results were the disintegration of the Dual Monarchy and of Russia, the abolition of the German Empire, and the deposition of hereditary rulers in the smaller German states, which instituted republican Governments. The following new states were formed from the constituent parts of Russia and Austria-Hungary: Albania, Armenia, Azerbaijan, Czechoslovakia, Estonia, Finland, Georgia, Latvia, Lithuania, Yugoslavia, and Ukraine. Poland, dissolved in the eighteenth century, was again reconstituted. France regained Alsace and Lorraine, Turkey lost almost all her possessions in Europe, whilst Belgium, Denmark, Greece, Italy, and Roumania were greatly enlarged, acquiring new territories. All these alterations of boundaries and additions of territories were based on ethnological grounds, the new states being inhabited by peoples belonging to the same ethnical group and speaking the same language. See articles on the various countries.—BIBLIOGRAPHY: E. A. Freeman, *General Sketch of European History*; A. Hassall (editor), *Periods of European History*; *European History Chronologically Arranged*; A. S. Rappoport, *History of European Nations*; O.

Browning, *General History of the World*; H. S. Williams, *The Historian's History of the World*.

**European War, 1914-8.** The European War, which began in Aug., 1914, and involved the greater part of the globe before the last shot was fired in Nov., 1918, had its ostensible origin in the assassination of the Austrian heir-apparent, the Archduke Franz Ferdinand, and his wife, at Serajevo, capital of Bosnia, once part of the ancient kingdom of Serbia. This crime was committed by a Bosnian student, but Austria-Hungary held Serbia responsible, and, inspired by Germany, sent an ultimatum on 23rd July, amounting to a demand that Serbia should surrender her independence. Two days later, notwithstanding that Serbia conceded every demand, with two reservations which she offered to submit to the Hague Tribunal, Austria-Hungary declared war on her. Germany, who had seen in the Serajevo tragedy a pretext for making her long-premeditated bid for world dominion, "knew very well what she was about in backing up Austria-Hungary in this matter", as the German Ambassador in Vienna frankly told the British representative at the time; and when Russia, as the traditional protector of the Slavs, mobilized her southern armies to save Serbian independence if necessary, she threatened instant mobilization on her own part unless Russia stopped these military measures within twelve hours. It was technically impossible for Russia to do anything of the kind, but her protest to this effect was unavailing. Germany declared war on Russia on 3rd Aug., and as this inevitably involved war at the same time with Russia's ally France, she sent a note on the following day to Belgium demanding safe passage for German troops through Belgian territory, though Prussia as well as Great Britain, France, Russia, and Austria had guaranteed the neutrality and independence of Belgium by the treaty of 1839, repeatedly confirming this on subsequent occasions. When the British Ambassador in Berlin protested against the threatened violation of treaty rights, the German Chancellor, Bethmann-Hollweg, repudiated the treaty as a mere "scrap of paper".

On 3rd Aug., when Germany formally declared war on France—though her troops had already invaded French territory at various points—Belgium refused Germany's demands, and called on Great Britain and France for assistance. It was this call, and Germany's refusal on the following day to accede to the British demands that Belgian neutrality should be respected—declaring war on Belgium instead and violating her territory early that morning—which decided Great Britain to range herself wholly on the Franco-Russian side. The German Ambassador in London had already been warned (on 31st

July) that we should be drawn into the struggle if Germany persisted in her threatened attack on France. Two days previously Germany had made the 'infamous bid' to Great Britain that if she would remain neutral no territory would be taken from France herself, though no undertaking could be given with regard to the French colonies. British mobilization orders were issued on 4th Aug., and at 11 p.m. on that date Great Britain declared war on Germany.

Fortunately the British navy was ready for any emergency, with the Grand Fleet—the command of which was given to Admiral Sir John Jellicoe—still assembled in full strength at Portland, after the manoeuvres, the order for its dispersal having been countermanded on 27th July. Lord Kitchener, home on leave from Egypt, had also been stopped by a telegram from Mr. Asquith, then Prime Minister, as he was stepping on the Channel boat at Dover on his return journey (3rd Aug.), and two days later was appointed Secretary of State for War. Meantime the Austrians had already bombarded Belgrade (20th July); Italy had declined (1st Aug.) to be drawn into the conflict with her Austro-German partners of the Triple Alliance on the grounds that their war was an aggressive one; and German troops, as already mentioned, had invaded France at several points on 2nd Aug., before formally declaring war on that country.

#### *Western Front, 1914*

The struggle on the Western front began in earnest on the following day, when war was declared on France and the Germans captured Trioux, near Briey, and Lunéville was bombarded by German aeroplanes. The German system of mobilization had been quicker than the French and Russian, but the opening moves filled the Allied commanders with too-confident hopes. Although slower to mobilize than the Germans, a Russian army under Rennenkampf succeeded in invading East Prussia in force; the Belgians made a magnificent stand for their frontier fortresses when the Germans, denied the right of way which they had demanded, endeavoured to force the great highway of Western Europe which passes through Liège; and the French, besides checking the enemy at Dinant, had already recovered part of the lost provinces of Alsace-Lorraine.

On 10th Aug. the First British Expeditionary Force, under General Sir John French, completed its landing at Boulogne, and four days later had arrived and concentrated on the line Avesnes-Le Cateau, on the left or exposed flank of the French Fifth Army under General de Lanrezac. It consisted of 50,000 infantry with its artillery, and five brigades of cavalry—some

70,000 troops altogether, a mere drop in the ocean compared with the millions of men who were marching to battle for the great military powers, but destined to play a part in the forthcoming struggle out of all proportion to its size.

The position at this juncture was, briefly, as follows: the Germans having at length captured the last forts of Liège, with its gallant commander General Leman, were overrunning Belgium. Brussels had just been evacuated (20th Aug.), and the main Belgian army, menaced by greatly superior forces of the enemy, and disappointed in its hope of effective support from the Franco-British troops, was retiring to seek the protection of the forts of Antwerp. Having occupied Brussels on the 20th, the German Higher Command appointed Baron von der Goltz as Governor. A reign of terror in Belgium had already been inaugurated as part of Germany's deliberate policy of 'frightfulness', including the ruthless execution of civilians on unsubstantiated charges of shooting at the invaders.

The French armies, under the supreme command of General Joffre, who, like Lord Kitchener, had been an engineer student when the Franco-Prussian War broke out, and had been Chief of the General Staff since 1911, were now disposed for the double purpose of meeting the threatened German onslaught and preparing the counter-offensive on which French doctrines of strategy had been based. Starting from the Swiss frontier there were nine divisions forming the Alsace force, the main offensive group, consisting of the French First and Second Armies, being extended along the Lorraine frontier, and the Third Army about Verdun. The Fourth Army formed the mass of manœuvre held in reserve behind the centre, while the Fifth, whose left wing was now extended by the British Expeditionary Force, faced the Ardennes as far as the Belgian frontier.

Germany was not seriously alarmed by the spectacular advance of the French into their lost provinces. It suited the strategy of her War Staff to keep the French mass of manœuvre as far as possible from the point at which it would soon be sorely needed; and their feint attacks in the direction of Longwy, Lunéville, and Belfort were designed to strengthen the belief that their real offensive would come in the frontal assault which the French dispositions had assumed. Germany, however, had always intended to strike through Belgium when the time came to deliver the knock-out blow to France before Russia had time to mobilize her millions.

The German advance was proceeding according to the plan which had been worked out in detail as far back as 1904 by the soldier-scholar of the *Garde-Ulanen*, Count von Schlieffen, who



died two years before his great scheme was put into execution. Based on the assumption that Germany and Austria-Hungary would have to fight France, Russia, Great Britain, and Belgium without the aid of Italy, it provided for an immediate attack by the right wing of the German army of such weight and ferocity as to destroy the French left by a single blow, and then roll up the main French armies one after the other. The South and Russian fronts were meantime to be lightly held, everything being staked on the sudden, overwhelming blow in the north through Belgium. One of the bitter controversies in Germany, after the war, raged round the responsibility for the failure of this plan, the execution of which devolved on General von Moltke, nephew of the great strategist of the Franco-Prussian War. The Kaiser believed that the name of Moltke would strike terror into the hearts of Germany's enemies, but the second Moltke lacked the genius of his predecessor, and the course of events proved that he was not equal to the task of carrying out so prodigious a plan.

It was doubly necessary to strike at once with an immediate maximum of strength now that Britain had already ranged herself alongside the Allies. This maximum of strength was attained long before France had completed her mobilization, and enabled Germany to launch her unexpected blow with crushing effect. She had reckoned, however, without the stubborn defence of the Belgians in the opening moves of the game, a defence which clogged the wheels of her mighty war machine at the critical moment; and was wholly unprepared for Britain's great achievement in transporting her 'insignificant' but indomitable army, without a hitch, complete in every detail, and establishing it in its place in the line of battle, hundreds of miles from its base, in less than three weeks from the declaration of war. Clearly there was no time to be lost in solving the military problem on the Western front before the Russians could throw their full weight into the scales.

The secret of Germany's sudden attempt to overwhelm the Allied left by an outflanking movement was well kept. The position in Belgium was obviously grave; but Joffre still clung to the belief that if the Germans attacked the Allied left in force, they would leave their own position in front of the French Fifth Army so exposed as to give him an opening for a successful counter-stroke with de Lanrezac's troops in co-operation with the British. Up to the 22nd General French's preparations were all in the direction of offensive action on these lines; his two corps had taken up their positions through Blinche and Mons and along the canal to Condé.

The German tide which now swept through the plains of Belgium entirely upset the Allied

calculations. General French woke on 22nd Aug. to find the troops of the French Fifth Army on his right in unmistakable retreat. The full force of the German blow, delivered by von Buelow's Second Army, had been felt by de Lanrezac's troops on the Sambre at day-break, and had pressed them back from the river. The British position held by the 1st Corps (1st and 2nd Divisions) under General Sir Douglas Haig, the 2nd Corps (3rd and 5th Divisions) under General Sir H. Smith-Dorrien, and the Cavalry Division under General Allenby, became isolated by the retreat of de Lanrezac—"the most complete example", as Lord French long afterwards described him, "of the Staff College pedant whose 'superior education' had given him little idea of how to conduct war". De Lanrezac asked General French if he would attack the flank of the German columns which were pressing him back from the Sambre, but the British Commander, who had received definite instructions from Lord Kitchener that his command was to be an entirely independent one, "and that you will in no case come in any sense under the orders of any Allied general", replied that with his own position so seriously threatened by the retreat of de Lanrezac's troops such an operation was impracticable, but he agreed to retain his present position for the next twenty-four hours.

The British army fulfilled this pledge, and the barrier thus held and maintained during the subsequent retreat, though shattered in parts, saved the French left from being outflanked by the invading right wing of the Germans under von Kluck. The whole situation became extremely critical on the following day (23rd Aug.). Namur, the forts of which had been regarded as impregnable, fell before the crushing attack of the heavy Austrian howitzers brought up by the advancing Germans; the French thrust into Alsace-Lorraine had just been countered by the German Fifth Army under the Crown Prince Rupprecht of Bavaria, which compelled the French to retreat from all but a corner of Alsace; and the main German attack, launched at the other end of the line, forced the French back both from the Sambre and the Meuse. The French Fifth Army, the position of which was considerably weakened by the fall of Namur, was attacked both by von Buelow's army in front, and by a Saxon army under von Hansen on its right. It was forced back until von Hansen found a gap on its right flank, through which he proceeded to pour his Saxons with the object of rolling up the French Third and Fourth Armies under Ruffey and Langle de Cary. These retreated in turn, to recover alignment with de Lanrezac's Fifth Army, which had retreated from the British right. The British army was thus left 'in the

air', outflanked not only on the right, where von Buelow was now advancing on it from Charleroi, but also on the left, where von Kluck's right wing was sweeping down in full force from the north-west.

The onslaught on the British front began shortly after noon with a bombardment of some 600 guns along the whole line of 23 miles; followed by a great frontal attack in mass formation. The British troops, all experts at musketry, used their rifles with such deadly effect that the frontal attack crumpled up. The line held; but with the German tide surging round on either flank the position became increasingly critical. Under the threatened turning movement General Smith-Dorrien withdrew from the Mons salient, and before nightfall took up a fresh line some 3 miles south of the canal. The advanced troops of the 1st Corps had not been seriously engaged, and held their ground. It was not until late that night that the desperate situation on his right was fully revealed to General French; and when news also arrived from Joffre that the British army would probably be attacked the next day by at least three German corps and two cavalry divisions, it became clear that a general and immediate retirement was inevitable. What actually happened was that the enemy attacked with no fewer than four corps, and at least two cavalry divisions.

#### *The Retreat from Mons*

The great retreat began shortly after dawn on the 24th with a feint attack by the 1st Division, under cover of which the 2nd Corps moved back 5 miles, and then stood in turn to protect the retirement of the 1st Corps. Further withdrawals were effected that day by alternate corps, covered by heavy rear-guard actions, until the 1st Corps had reached the line between Maubeuge and Bavai, with the 2nd Corps extending the line from Bavai to Bry. Von Kluck's army, though kept in check by the retreating troops, followed closely on their heels and round their left flank, their design apparently being to turn the British left and press them back on Maubeuge, the fortress close on their right rear, which, well fortified and provisioned as it was, offered, as General French afterwards pointed out (in 1914), a terrible temptation to an army seeking shelter against overwhelming odds. Bazaine's example at Metz in 1870, and a shrewd suspicion that the German move was deliberately planned with that end in view, proved sufficient reasons for avoiding the trap. A further retreat was accordingly ordered to the line Le Cateau-Cambrai, some miles farther back.

Tournai, which was held by a French Terri-

torial brigade, fell that day. There was nothing apparently to prevent the German host at this juncture from continuing its course to the coast and seizing the Channel ports as far as the Seine. That, doubtless, would have been included in the programme had the Germans anticipated a campaign of any considerable duration. The Kaiser, however, had promised his troops that they should be home again "before the leaves fall"; and to bring this about it was necessary to settle with the Allied army once and for all. Where von Moltke failed, according to Ludendorff and other critics after the war, was in not striking further to the north or north-west, and in not throwing still more weight into the scale from his left wing.

On the 25th the French were still retreating all along the line save at Maubeuge, the garrison of which held out until 7th Sept., and at Longwy, north of Verdun, which fell on 28th Aug. The British army, battle-worn and suffering severely from the heat, but resisting all the German efforts to turn its western flank, marched stubbornly back, gallantly assisted by Allenby's cavalry. The French were a day's march ahead of them when the British reached the Le Cateau position. General French decided, therefore, that, sorely as the troops needed rest, there was nothing for it but to resume the retreat at day-break, and issued orders to that effect. The hardest fighting on the 25th had fallen to the 1st Corps at Landrecies, where Haig's weary troops were violently attacked at nightfall, before they could snatch any rest, by fresh enemy troops sent forward in pursuit in motors and lorries. The German infantry paid dearly for their temerity in advancing through the narrow streets of the town in close order, two or three British machine-guns mowing them down in hundreds. The attack was a disastrous failure.

The 2nd Corps did not reach Le Cateau until ten or eleven o'clock that night, thoroughly exhausted after a hard day's fighting and marching. Smith-Dorrien had lost heavily in the operations, and was so convinced that his troops were unfit to resume the march at daybreak that he elected to stand and abide by the result. The magnificent fight put up by his troops on the following day, assisted by Allenby and Sordet's cavalry, and two divisions of French Territorial troops under d'Amade, which had been detailed to guard the British left flank, saved the situation, and averted, in the considered opinion expressed by General French five years later, "a stupendous repetition of Sedan". The actual result was a total loss of some 14,000 officers and men, about 80 guns, and numbers of machine-guns, as well as quantities of ammunition and material. According to General French, these losses heavily handi-

capped the British army in the subsequent stages of the retreat, and were felt throughout the first battle of the Marne and the early operations on the Aisne. In his dispatch of Sept., 1914, the British Commander-in-Chief had written of this battle in eulogistic terms. It was not till some time later, he explains, that he came to know the full details of the battle and to appreciate it in all its details. For General Smith-Dorrien it is urged that his stand at Le Cateau broke the full force of the German pursuit, and checked its course in time.

On the 27th the shattered 2nd Corps, having broken off the action, continued the retreat with the 1st Corps. On the 28th Gough, with the 3rd Cavalry Brigade at St. Quentin, and Chetwode, with the 5th at Cérizy, turned on the leading German cavalry at both these places and threw them back on their main bodies in confusion. For the first time since the retreat began the worn-out British infantry, having reached the line of the Oise between Noyon and La Fère, were able to rest and sleep in peace.

On the 29th the British troops reached the line Compiègne-Soissons, the Germans on the same day occupying La Fère and Amiens, as well as Rethel and other towns along the French front. Bapaume held out until the rolling-stock had been removed from Amiens, but the flood-tide of invasion now seemed to be carrying everything before it. Uhlans threatened to cut Sir John French's communications with his base at Boulogne and Dieppe. The base was accordingly transferred to St. Nazaire, at the mouth of the Loire. Timely help came to the retreating British troops on the 29th by a brilliant counter-stroke near Guise on the part of the French Fifth Army on their right; but neither the British nor the French troops on de Lanrezac's right were in a position to make a stand in support of that reaction. The Aisne was forced by the invaders on the 28-29th, and Rheims, Châlons, and Laon abandoned to them within the ensuing forty-eight hours. Falling back doggedly from the Aisne and the Oise, the British troops withdrew on 2nd Sept. to Chantilly-Nanteuil, the German advance having been checked on the previous day by the 4th (Guards) Brigade in a stiff rear-guard action at Villers-Cotterets.

The great retreat was coming to an end. Victory and Paris seemed within the enemy's grasp. He had—as he thought—so shattered the British army that it was now entirely negligible as a fighting force. He was ignorant of the real strength of the force that was gathering on the British left north of Paris—the new French Sixth Army under General Maunoury. It seemed both to von Kluck and the German Higher Command that they had only the shaken

French Fifth Army seriously to reckon with on the Allied left, and, as von Kluck was considered more than strong enough for the task, von Moltke took the Garde Reserve Corps and 11th Army Corps from his right wing to East Prussia, where the Russians were now carrying the war well into the Fatherland.

The help rendered by the Russians at this critical phase of the war was invaluable, and played no small part in the approaching struggle on the Marne. In his fears for the safety of Paris, Joffre was naturally anxious to profit by this relief, and discussed with Sir John French the possibility of taking the offensive at the earliest possible moment. There appears to have been some misunderstanding as to Sir John's plans at this point. The British Commander-in-Chief declares that he had every intention of remaining in the line and filling the gap between the French Fifth and Sixth Armies, but the French Higher Command was apparently under the impression that he was determined not to fight any more until his troops had been given a week to reorganize and refit. Lord Kitchener himself hurried to Paris to clear the matter up, but "full accord", according to President Poincaré, long afterwards, "was not re-established without trouble". As soon, however, as the offensive was ordered, continued the same authority, the British Commander-in-Chief gave his assistance without reserve. "His army fought with magnificent courage, and Great Britain played a brilliant part in the common victory."

In the meantime the retreat continued, the British, on 2nd Sept., reaching the line of the Marne towards Lagny and Meaux, with the French Fifth Army, now under the command of Franchet d'Espèrey, on their right, retiring on Château-Thierry, and Maunoury's new Sixth Army, on their left, retiring towards Paris. It was at this point that von Kluck made the fatal mistake of dismissing the British army as practically crushed and out of action. Diverting the advance of the German First Army, he left Paris on his right in order to deal what he hoped would be a decisive blow at the French Fifth Army south of the Marne. By 5th Sept. the British army had fallen back to the Forest of Crécy to bring it in line with the French Fifth Army.

Not only was the British army at length receiving sorely needed reinforcements, but the French army was every moment increasing in strength and numbers as it fell back on its reserves. Besides the French Sixth Army on the British left, another new French army had sprung into being behind the marshes of St. Gond—the Ninth, under Foch, who filled the gap between Franchet d'Espèrey's Fifth and Langie de Cary's Fourth Army—behind Vitry. Eastward

the line was continued by the French Third Army, now commanded by Sarrail in place of Ruffey; and Castelnau's Second Army, now fighting the battle of the Grand Couronné de Nancy which stemmed the German invasion at this point, and prevented the threatened envelopment on the Allies' right, where the Kaiser himself had gone to inspire the troops of Prince Rupprecht of Bavaria.

### *First Battles of Marne and Aisne*

Secure on the right, Joffre was at last able to deliver the great counter-stroke on the left which the Germans had invited by their tremendous bid for swift and decisive victory. The retreat came to an end on 5th Sept., when Joffre gave Sir John French his final plans for the coming offensive, and von Kluck, ignorant of the recuperative powers of the British, as well as of the strength of the French Sixth Army on their left, marched across their front in pursuit of d'Esperey's Fifth. That night the Germans crossed the Marne, and the Grand and Petit Morin—two streams which branch off roughly parallel to one another south of the Marne—while some of their patrols reached the Seine, there catching a fleeting glimpse of the capital where they confidently hoped the French would soon be brought to terms.

When at last the retreat came to an end, the British army had been reinforced by the 4th Division, which, with the 19th Infantry Brigade—and subsequently the 6th Division—became the Third Army Corps under General Pulteney, who arrived in France to take command of it on 30th Aug. Deficiencies in armament and material had also been partially made good, but, most important of all, Sir John French bore witness, "the promise of an immediate advance against the enemy had sent a thrill of exultation and enthusiasm throughout the whole force".

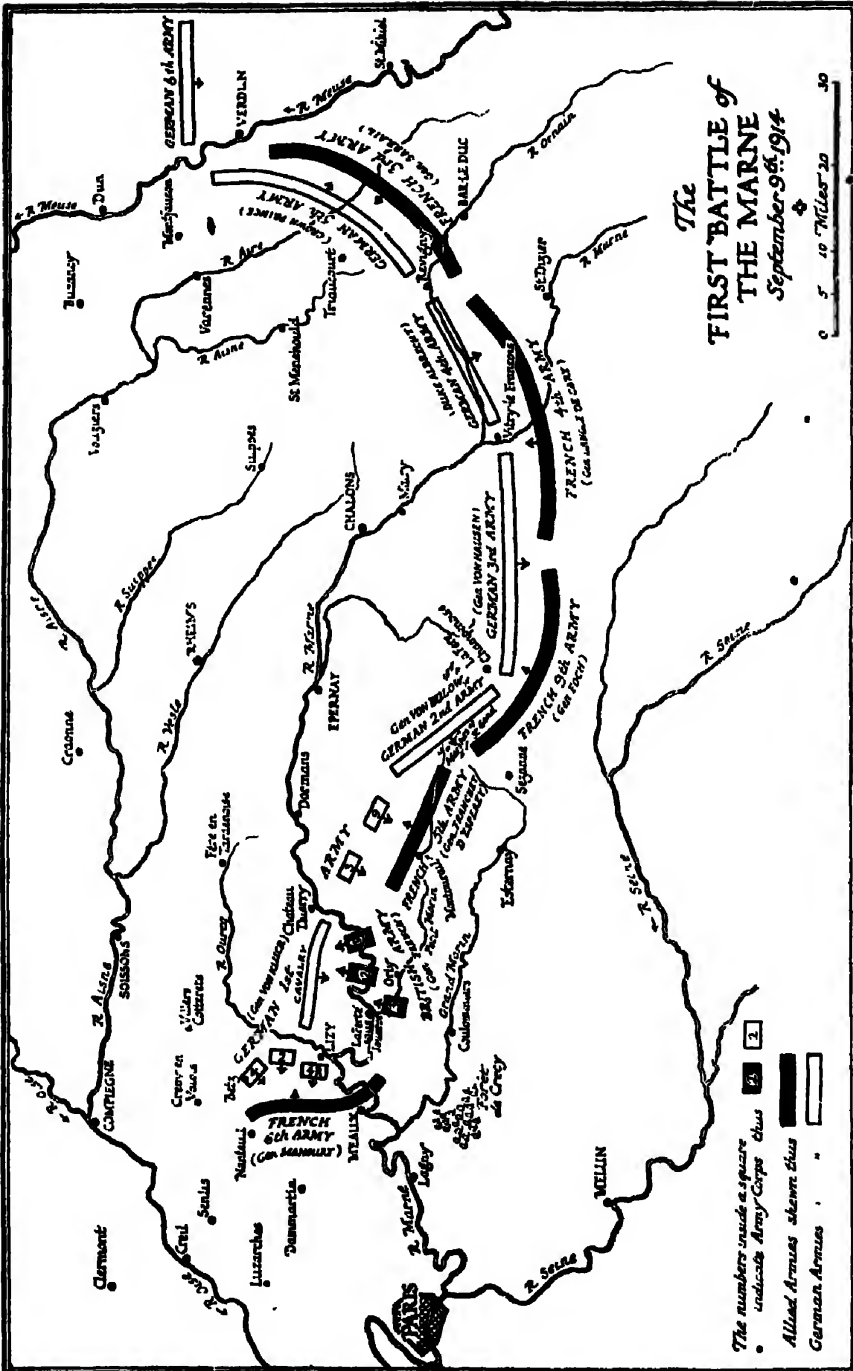
The first battle of the Marne had scarcely opened on 6th Sept., 1914, when von Kluck, realizing that Maunoury's force on his extreme right was becoming dangerous, sent two army corps northwards to deal with it. Maunoury had already crossed the Marne and fought the first battle of the Ourcq on the 5th. The dispatch of the two German corps to keep him in check made a way now for the British troops, when, according to plan, they turned on the invaders with the object of assailing their flank with the French Sixth Army on their left; while the French Fifth Army, and the French armies to its right, made a simultaneous frontal attack.

Both Joffre and French were under the impression that the German thrust was still in full career when their counter-stroke was delivered. Already, however, the tide had begun to turn.

Von Kluck, realizing too late—what should have been obvious from the first—that his communications were being seriously threatened on the Ourcq, saw that retreat was inevitable unless he could crush the forces gathering so ominously against his right flank. The opening of the battle of the Marne thus became on von Kluck's part an effort to overwhelm Maunoury on his right, while he kept the British army and French Fifth Army at bay with strong rear-guards and cavalry. The surprise of the day to the Germans was probably the remarkable part played by the British, who, instead of being practically wiped out, as the enemy fondly believed, attacked with an energy and dash which carried everything before them, and, but for filling their allotted rôle of maintaining alignment with the French armies on each flank, would doubtless have advanced farther than they did. As it was, the progress made was considerable. The Germans were driven back to the Grand Morin, and the line of that stream made good on the following day.

Meantime the French Fifth Army on their right, materially helped by this success, had also recovered a good deal of ground, while Foch and Langle de Cary, farther east, held their own against the fierce assaults of the German centre. A last desperate effort was being made to hack a way through at this point, and Sarrail, on Langle de Cary's right, had to give way a little along the Meuse. That day the Germans reached the most southerly point of their advance, at Provins. The deciding phase of the battle, however, was developing with dramatic swiftness on von Kluck's right wing. Maunoury was hard pressed by the repeated onslaughts of the enemy, whose heavy reinforcements at this point held the issue in the balance for several days. General Gallieni, the Governor of Paris, hurried up fresh troops to Maunoury in motor-buses and taxis, and the French line held.

The British army helped matters considerably by driving the Germans across the Grand Morin at Coulommiers on the 7th, and on the following day from the Petit Morin, thus also helping d'Esperey with the French Fifth Army, on its right, to continue his advance farther east as far as Montmirail. On the 9th came the decisive blows which removed all doubts as to the issue of the battle. Von Kluck's retreat on his left flank exposed the right of von Bülow's Second Army, which was further jeopardized by a gap which appeared on its left, where it should have linked up with von Hausen's Third Army. This double opening gave Foch, facing von Bülow in the marshes of St. Gond, the opportunity which he sought of smashing the enemy's centre. He seized it by a series of lightning blows which drove the German centre back on the morning of



the 10th in complete disorder, pursued by Foch's victorious infantry.

All the reinforcements sent to von Kluck were now of no avail against the French Sixth Army, which had been fighting against odds since 6th Sept., helped not a little by Pulteney's 3rd Corps on its right flank. Maunoury carried the Oureq on the 9th, and Pulteney's corps was able to cross the Marne, after stiff fighting at La Ferté-sous-Journe, at dawn on the following day, when the German retreat became general. The left of the British 2nd Corps had crossed the Marne at Nanteuil, where the bridges were found unbroken and the enemy gone, on the morning of the 9th, but was ordered not to advance too far north until the 1st and 2nd Corps were firmly established on the northern bank. The 1st crossed later in the day at Charly-sur-Marne and Sauleh ry, clearing the ground of the enemy and making many captures; but the 3rd Corps had a harder task at La Fert -sous-Journe, and, as already mentioned, was not completely established on the other side until the following morning. The first battle of the Marne ended on the night of the 10th with the enemy in full retreat to the north and north-east and the Allies in hot pursuit. By the 12th he had been driven back from the Seine a distance of 65 miles, and the great German plan of a sudden crushing defeat of the Allies in the West had collapsed like a house of cards.

The hopes thus raised among the Allies of a speedy termination of the war in their favour were, on the other hand, equally illusory. Though the Germans lost heavily in officers and men, as well as in guns and other war material, their retreat was no disorderly flight. Many desperate rear-guard actions were fought all along the line, but the enemy retired steadily to prepared positions on the Aisne, where the eyes of all the commanders were to be opened to the possibilities of trench warfare under modern conditions. It needed many hard lessons before the truth was driven home.

When the first battle of the Aisne opened on 13th Sept., the British army already had its outposts on that river, the main body being in positions somewhat to the south, between Soissons and Reims. Throwing bridges across during the night, the advance was continued on the opposite bank on the following day, though not without heavy British casualties, amounting to between 1500 and 2000, including 3 commanding officers. The 6th Division arrived from England at this stage, and joined its own 3rd Corps on the left. Further advance was stayed by the strength of the enemy's entrenched positions, in which he now determined to make his stand. Here he was backed by an overpowering superiority in artillery which, with fierce counter-

attacks on the part of his infantry, gallantly repulsed though they were, caused such severe losses that the British Commander-in-Chief was forced to assume a defensive r le, while Maunoury, de Castelnau, and Foch each made stupendous efforts to break the enemy's line and renew the war of movement and manoeuvre on which their military principles had been based. All, however, ended in the same dreary deadlock of entrenchments.

Failing to shift the enemy from these impregnable positions, Joffre endeavoured to outflank the German right wing, already threatened by Maunoury's advance along the Oise. Two new French armies were formed from the reserves to extend the Allied left—the Seventh, entrusted to de Castelnau, whose Second Army was transferred to Dubail, and the Tenth, the command of which was given to Maud'huy. De Castelnau's Seventh Army, though it failed to turn the enemy's flank—the movement having been anticipated by him—succeeded in extending the pressure of Maunoury's left, which had swung round by the 20th until it ran north from Compi gne to west of Laon, and in building the first section of Joffre's great besieging wall which, gradually extending from the Alps to the sea, became the impenetrable barrier between the enemy and his main objectives. The Allies' line was continued by de Castelnau through Roye to Albert, and thence, by Maud'huy's Tenth Army, through Arras to Lens.

Von Moltke had now been superseded in the German Higher Command by Falkenhayn, who promptly countered Joffre's new strategy by similar extensions of the German front, thus beginning the outflanking race destined only to end in stalemate on the coast. While extending their right the Germans made a strenuous effort to regain the initiative by a blow with the army group nominally commanded by the German Crown Prince on Sarraill's flank on the Meuse. It was a blow aimed at Verdun and the whole of the Allied line, which it hoped to break through at this point and so take in the rear. Verdun, however, had been rendered impenetrable by miles of powerfully protected outer defences, and practically the only success which fell to the Crown Prince on this occasion was the capture of the Camp-des-Bommes and St. Mihiel on the Meuse, thus creating the remarkable salient east of Verdun which was destined to remain until the Franco-American force flattened it out in the victorious advance of the Allies four years later. The German Crown Prince fared even worse a week later, when he attacked along the main road through the Argonne towards Verdun, only to be flung back. It was after this double failure that the Germans bombarded Rheims and shattered her noble cathedral.

The crucial phase of the struggle in the West had shifted towards the coast as the first battle of the Aisne died down on 28th Sept., and the campaigns began in Artois which led in due course to the fierce struggles for the Labyrinth, the Vimy Ridge, Lens, and Loos. The extension of the French left placed the British army in an anomalous position. Even before Joffre had begun to build his barrier in this direction the British Commander-in-Chief had felt strongly that his proper sphere of action was on the Belgian frontier on the left flank of the French armies, for the two-fold purpose of defending the Channel ports and being in position to concert combined action with the British navy. He suggested this move to the north to Joffre on 20th Sept., pointing out its strategical advantages and the possibility of doing so now that the position of his force on the right bank of the Aisne had been thoroughly well entrenched. Joffre agreed in principle to General French's proposal, but postponed the movement until 3rd Oct.

#### *Retreat from Antwerp*

By this time the critical situation of the Belgian army at Antwerp had become hopeless, and the danger of a German descent on the Channel ports suddenly became acute. Since their retreat towards Antwerp after their evacuation of Brussels on 20th Aug., the Belgians had kept the Germans at bay by vigorous counter-attacks, and threatened their communications by sundry sorties from the fortress. These sorties and counter-attacks, calling for reinforcements at a time when every soldier was needed on the main fighting fronts, infuriated the Germans and led to the reign of terror which included the deliberate destruction of Louvain and similar outrages at Malines, Termonde, and elsewhere.

Having made his position secure on the Aisne, and brought up his heavy guns, the enemy began his bombardment of the outer forts of Antwerp on 28th Sept. By the 3rd of Oct. the Belgians were endangered not only by the besieging army, but also by the ever-lengthening German line which, having now been extended from Lassigny to Lille—only 38 miles from the sea—threatened to isolate the Belgian forces from the Franco-British armies. They accordingly decided that plans must be made at once to withdraw from Antwerp in the direction of Ghent, both to protect the coast-line and gain touch with the Allies. The British troops hurriedly sent to reinforce the Belgians—a brigade of Royal Marines and part of the recently formed Naval Division—had no influence on the fate of the fortress, but helped in protecting the flight of the citizens and in the final retreat of the Belgian army. Some 1500

of the Royal Naval Division were forced across the Dutch frontier and interned, and about 800 were made prisoners. The remnants of the British force, and the bulk of the Belgian army, escaped westward, leaving the Germans on 9th Oct. in possession of the deserted city. A little more and the German commander (von Beseler) might have closed the gap beyond the Scheldt through which this retreat had been made. Luckily for the Allies, too, the German Higher Command failed, as Lord French long afterwards expressed it, to gather the richer harvest which had been put within its grasp by the capture of Antwerp. There was then apparently no insuperable obstacle to an immediate German advance on Dunkirk, Calais, and Boulogne, before the Allied troops could arrive from the main theatres to prevent it. "As on the Marne, so at Antwerp, they were not prepared to seize the psychological moment and to play boldly for the great stake".

General French, who had been given no voice in the Antwerp dispositions, was now in the midst of the British move from the Aisne front to the north, where he was to be reinforced by the 7th Infantry and 3rd Cavalry Divisions, which had been landed on the Belgian coast to defend Zeebrugge and Ostend under Rawlinson's command, and the Indian contingent, which had just arrived at Orleans under Willcocks.

#### *First Battle of Ypres*

The two corps under de Castelnau and de Maud'huy were now under the supreme command of General Foch, who had orders to control all the French armies operating in the northern theatre, and was confident that it was still possible to outflank the Germans and bend them back behind the Scheldt. At the end of a fortnight the British army had been successfully transported to the north from the Aisne—after successfully holding the line of that river for twenty-five days against many desperate efforts of the enemy to break through—and had taken up its position on the left of Maud'huy's corps, the Allies' line being extended thence into Flanders by the French 8th Corps (under d'Urbal), which had been called up by Joffre to this end, as well as to help the sorely tried Belgians. Meantime the Germans, besides pressing Maud'huy hard in front of Arras, and forcing his Territorials out of Lille, had driven the retreating Belgian army out of Houthulst Forest to the line of the Yser north of Ypres, whence it took refuge behind the Yser and completed the Allied line to the coast. Rawlinson's 4th Corps, covering the retreat of the Belgian army, had hard fighting most of the way before it succeeded in joining the main



British army, the German forces from Antwerp concentrating westwards in ever increasing numbers. By the 15th Capper's 7th Division was east of Ypres, while Byng's 3rd Cavalry Division, a day earlier, had connected up with Gough's 2nd Cavalry Division in front of Kemmel and assisted in the capture of that position, a gain which proved of the utmost importance in the subsequent struggle for Ypres. Allenby's Cavalry Corps had greatly distinguished itself during the two previous days, driving the enemy back all the way in a magnificent sweep to the north and north-east.

A brilliant series of advances by Pulteney's 3rd Corps on 12-15th Oct., leading to the capture of Bailloul and Meteren, and the line Salliy-Nieppe, confirmed French in the belief which he shared with Foch that the enemy had exhausted his strength, and that the time was ripe for a strong offensive eastwards. The advance had scarcely been started, however, before reports arrived of a powerful offensive on the part of the Germans towards Ypres and the Yser. The power and weight of the enemy's opposition on the British front increased each day. Armentières and the Bois Grenier were won by 15th Oct., but the failure of the 4th Corps in its advance on Menin was one of numerous indications that the Germans were being heavily reinforced. By the 21st all General French's worst forebodings were realized by the certainty established that the small German force which had been operating between Ostend and Menin on the 18th had been increased by no fewer than four corps. This discovery, in the British Commander-in-Chief's own words, "came like a veritable bolt from the blue". There was no longer any hope of continuing the offensive on the part of the comparatively weak British line, extended as it was on too long a front. It was a case of holding on now until relief arrived.

The threat was twofold. Not only were the Germans massing in tremendous strength in the north; they were also seriously threatening the British right. Maud'huy, round Arras, was fighting a battle which, like that which the British were waging round Ypres, was one of the landmarks of the war. He sent word on the 10th that the enemy was intent on driving in a wedge between Ypres and La Bassée—a threat which, had it matured, would have finally separated the Allies, and compelled the British either to surrender or be driven into the sea. Faced by this double threat, General French decided to risk the possible disaster on his right, and concentrate against the German tide in the north, which otherwise must gain the seaboard, with possibly fatal consequences to the whole British campaign.

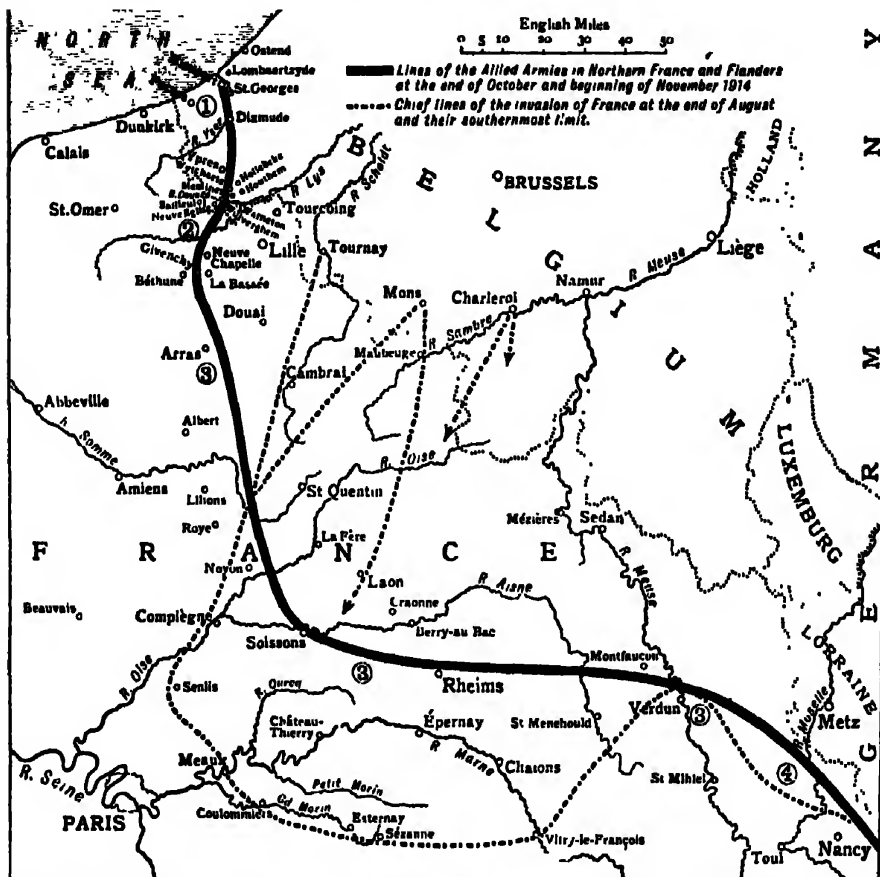
Fortunately the First Army under Haig had already been ordered in the direction best calculated to meet the new situation, though there was no longer any hope of its original orders—to turn the enemy's flank and drive him back to Ghent—being carried out. In this first phase of the battle of Ypres, which lasted until the night of 28th Oct., the northern portion of the British line, notwithstanding the enemy's immense reinforcements, progressed slowly but surely, and took heavy toll in killed, wounded, and prisoners. A certain amount of ground was lost to the south, between Zonnebeke and La Bassée—the commanders of both the 2nd and 3rd Corps being anxious about their positions on more than one occasion—but at no point was any serious break made in the line. Maud'huy at the same time was gallantly keeping the enemy in check in the Arras region, though he could not drive him from Lens and the Vimy Ridge; while on the left the French and Belgians were withstanding repeated assaults on the swaying front between Dixmude and the sea. The line held, and was now more or less firmly established.

The second phase of the battle of Ypres consisted in the repeated attempts of the Germans to break through this line at all costs. It began on 27th Oct., and lasted through five of the most momentous days in the history of the British army. On this day the French 9th Corps, which had been sent by Joffre to the assistance of the sorely tried British troops, took over the trenches in the northern part of the British salient. Capper's 7th Division, exhausted by incessant fighting and fearful losses, was temporarily attached to Haig's 1st Corps in the centre, and took over the ground south of the Ypres-Menin road. Byng's 3rd Cavalry Division was at the same time placed under Allenby. The 4th Corps was thus temporarily broken up, Rawlinson being sent home to supervise the preparation of the 8th Division for France.

The British line was further reduced in numbers during the opening days of this new phase of the battle by the repeated but unavailing attempt of the enemy to advance, the Germans meantime mounting up reserves of reinforcements for a decisive blow until, by the 30th, they outnumbered the battle-worn British by two to one. Then came the onslaught in full, almost overpowering strength. "October 31st and November 1st", afterwards wrote the British Commander-in-Chief in his story of 1914, "will remain for ever memorable in the history of our country, for during those two days, no more than one thin and straggling line of tired-out British soldiers stood between the Empire and its practical ruin as an independent first-class Power." The storm centre of the British

battle-line was the Wytshaete-Messines ridge, where Allenby's Cavalry Corps and Shaw's 9th Brigade of the 3rd Division withstood for forty-eight hours the supreme efforts of two and a half German army corps to dislodge them. The honours of those heroic days were shared by the French 9th Corps and the British 1st Corps

held by Haig's 1st Corps and the 7th Division, and forced our troops back on Gheluvelt. The ground was recovered before nightfall, but fighting of the fiercest character continued all round and beyond the salient, the critical sector of the 31st extending from Gheluvelt to Messines, on the south, where the 1st Cavalry Division was



Map showing lines of the Allied Armies in Northern France at the end of October and beginning of November, 1914

- 1, Yser line, defended by Franco-Belgian forces.
- 2, Ypres to La Bassée line, guarded chiefly by British troops.
- 3, French lines to a point above Verdun.
- 4, French lines adjacent to the Alsace-Lorraine frontier

(with the 7th Division attached) in their continued defence of the Ypres salient; and the British 2nd Corps, which held a long line on the right in difficult country, and, though forced to give up Neuve Chapelle on the 28th, withstood repeated attacks by superior numbers until the Indian Corps took over their positions.

The culminating phase of the battle began on the 29th, when overwhelming masses of the enemy stormed the centre of the Ypres salient,

heavily pressed, and the London Scottish received their costly baptism of fire. The Germans got into Messines that day, but were hurled out again, and the line in this sector was completely restored by nightfall. The climax of the crisis had been reached shortly after midday in the Gheluvelt area, when the 1st Corps, after doing more than could be expected of any men in their prolonged stand against the heaviest odds, was at last broken, part of the 1st Division

falling back rapidly along the Ypres-Menin road, with the Germans at their heels. "I felt", afterwards wrote General French, who was not more than a mile or so away at the time, "as if the last barrier between the Germans and the Channel seaboard was broken down", and he spent the worst half-hour his life had ever known. The situation was saved by Brigadier-General FitzClarence, V.C., commanding the 1st Guards Brigade of the 1st Division, who, on his own initiative, and in the nick of time, ordered the 2nd Worcesters to counter-attack. The Worcesters, who were in reserve to the 2nd Division, rushed up to fill the gap, and, saving the South Wales Borderers, drove the Germans out of Gheluvelt and re-established the line, which was completely restored before dark. FitzClarence was killed only a week or two later in the same part of the field.

The third phase of the battle of Ypres lasted from 1st Nov. to the 10th. Its most dangerous hours were at the very beginning, when both Messines and Wytschaete were lost, and only the timely arrival of the French 10th Corps, which partially restored the situation, and the devoted bravery of Allenby's Cavalry Corps, saved off this new threat of disaster. It is impossible here to follow all the confused operations in the remainder of this phase, in which fighting continued with varying intensity, and mingled success, all along the line from La Bassée to the sea.

The outstanding feature of the fourth and final phase, which extended from 11th Nov. to the 21st, was the succession of heavy assaults by the pick of the Prussian Guard, ordered by the Kaiser personally to carry the Ypres salient at all hazards. It failed, but not before the Germans had pierced the front along the Menin road in the first clash of arms on the morning of the 11th, a battalion of Royal Fusiliers being practically wiped out in gallantly disputing their passage. Haig met the situation "with the same grim determination, steadfast courage, and skilful forethought"—the words are those of Lord French—"which had characterized his handling of the operations throughout". The line was re-established, but only after fearful losses on both sides. The 1st (Guards) Brigade mustered at night only 4 officers and 300 men.

The French and Belgians were also attacked all along their line between Ypres and the sea—where British monitors swept the coast with shells for 6 miles inland—but the enemy was held off, save at Dixmude, which he captured and held. Between Dixmude, which had been stubbornly defended by Admiral Ronarc'h and his French marines, and Nieuport the sluices of the Yser had been opened by the Belgians,

and the low-lying country across which the Germans were striving to force a way so flooded as to render all their efforts futile.

It was during this final effort of the Germans to reach the Channel ports in 1914 that Lord Roberts arrived at the front to visit the Indian Corps, who had withstood some heavy assaults on the old line of the Second Army, between Armentières and La Bassée. Lord Roberts had scarcely fulfilled his mission, inspiring the troops with his presence at a critical time, when he was taken suddenly ill on 13th Oct. and died on the following day.

North of Armentières the British 3rd Corps under Pulteney, which held the line thence towards Messines, had its share of fighting on the left bank of the Lys, and though its deeds in maintaining its positions were overshadowed by the epic struggles in the salient, its minor battles played their part in the victory of First Ypres. The great battle died down with the failure of the supreme effort of the Prussian Guard. Ruins and floods and mud combined to call a halt in the struggle for the Channel ports, and the Western front was now established for the winter. There were occasionally attacks by the Germans at Ypres and Festubert, and more than one attempt on their part to cross the flooded Yser on rafts; but all to no purpose; and before the end of the year (20th Dec.) a five days' battle between the Indian troops and the Germans round Givenchy left matters much as they were before, the British positions, with the aid of British troops, being held. The French also broke the monotony of trench warfare with encouraging advances in Alsace, towards Noyon, in the Argonne, and elsewhere, but no vital changes took place in the general situation.

#### *Eastern Front, 1914*

Foiled in their grandiose plans in the West, the Germans were forced to rest content with their valuable territorial gains in France and Belgium, and remain on the defensive there while they turned to the more threatening situation on the Eastern front. As already noted, the Germans had under-estimated the rapidity of the Russian mobilization. They had not anticipated an offensive on that front until they could spare as many reserves as necessary from the West, and the forces left to guard their vulnerable frontier of East Prussia were as inadequate to stay the unexpected advance which the Grand Duke Nicholas, who was in supreme command of the Russian armies, ordered under Generals Rennenkampf and Samsonoff, as were the Belgians to prevent the march of the Germans across their territory. By 25th Aug. the Russian armies, whose advance had begun as early as

the 7th, had pushed so far ahead that all East Prussia seemed in danger of falling into their hands. General von François, commanding the German troops, had been driven into Königsberg, the cradle of the Prussian monarchy; Gumbinnen, Jüterberg, Allenstein, Soldau, had all been captured; and the hopes of a flight to Berlin before the Russian 'steam-roller'—too often raised in the early stages of the war—seemed not unlikely to be realized.

Germany's hour of danger, however, produced the man who was destined to play a ruling part in the remaining phases of the struggle—Paul von Hindenburg, a veteran of the Franco-Prussian War, then on the retired list. Hindenburg knew the topography of East Prussia by heart, and had commanded army corps in manoeuvres along that frontier for many years. Appointed at this critical moment to supersede General von François, he collected 100,000 men from every available source, and by means of Germany's unequalled strategic railway system had concentrated them in a favourable position between Allenstein and Soldau for delivering the blow which would cut the communications of the southern army under Samsonoff, and smash it piecemeal in the treacherous marshes of the Masurian Lakes, the tracks through which, though well known to Hindenburg, were a veritable tangle to the Russians.

Tempted by their initial triumphs, the Russians had themselves courted disaster by placing themselves in precarious positions. Samsonoff's southern army had not only lost touch with the northern force under Rennenkampf, which had occupied Insterberg on the 23rd on its march on Königsberg, but had also failed to secure either Allenstein or Soldau. Hindenburg was quick to seize every advantage, and his lethal thrust on the 26th, when he retook Soldau and outflanked the Russian left, was followed by a similar enveloping movement on their right before they realized what had happened. Masses of German guns came up and completed the move. Too late the Russians fled along the only road left open to them—by way of Ortelsberg and Johannisberg, across a narrow strip of land between the marshes. Save for little more than one corps, which succeeded in escaping along this route before it was closed, practically the whole of Samsonoff's army was wiped out in this decisive battle of Tannenberg, as the victors named it. Samsonoff himself was killed by a shell on 31st Aug. Altogether the Russians lost in killed and wounded some 80,000; no fewer than 90,000 were taken prisoners.

Hindenburg, whose Chief of Staff was General von Ludendorff—already distinguished in the war as the leader in the assault on Liège—at once became a national hero throughout Ger-

many. The Central Powers, however, had little further cause for rejoicing on the Eastern front in 1914, once Hindenburg had been enticed to the Niemen by the rapid retreat of *Rennenkampf* after the *Tannenberg débâcle*. The Grand Duke Nicholas had sent General Ruzsky from Galicia to retrieve the situation, and the new leader made as good use of the Niemen River—a formidable obstacle to cross with its width of some 200 yards—as Hindenburg had done of the Masurian Lakes. The operations, which ended in the failure of the Germans to cross the river, and their heavy defeat at Augustovo after a sanguinary nineteen days' battle beginning on 1st Oct., restored confidence to the Russian army.

General Ruzsky had already made his mark in the opening campaign in Galicia, where the Austro-Hungarian armies, after invading Russian Poland at the opening of the war, were driven back in a series of mighty battles which left the Russians in possession of Lemberg and all Eastern Galicia. Brusiloff was meantime sweeping on towards the Carpathian passes, while Ivanoff, commanding the Russians in Poland, forced back the invading armies under Dunkl and the Archduke Joseph Ferdinand beyond the Vistula and Cracow. Przemyśl alone held out in Galicia, and this was invested by the Russians towards the end of September, when the Germans, far to the north on the Niemen, were rapidly losing the advantage and prestige they had won at Tannenberg. Hence Germany's increasing need for help from the Western front.

In order to check the Russian advance on the key position of Cracow, Hindenburg was now called from the East Prussian front to take over the supreme command of the unified German and Austro-Hungarian armies in a crushing blow at the Russian centre in Poland. Hindenburg's advance on Warsaw was planned by his Chief of Staff, Ludendorff, to keep pace with a parallel advance of the Austro-German armies in the south, intended to raise the siege of Przemyśl and turn the Russians out of Lemberg. The combined forces of the Central Powers amounted to some two million men, outnumbering the Russians by at least half a million, and outgunning them completely. It speaks volumes not only for the fighting spirit of the Russian armies at this period of the war, but also for the strategy inspired by the Grand Duke Nicholas, that in both the first and second battles of Warsaw the combined Austro-German armies were both outfought and outmanœuvred. "The Grand Duke Nicholas", to quote from Lord French's tribute to his leadership some years later, "proved that he possessed that highest of military gifts—the power of renunciation,

of 'cutting down', of sacrificing the less essential for the more."

Foresceing the danger of Hindenburg's march on Warsaw, the Grand Duke promptly recalled the first great Russian advance on Cracow, and the armies concerned were safely withdrawn behind the Vistula and the San before the enemy could cut the main line from Warsaw to Kiev. Ivanoff's army in Galicia conformed to the general movement. While thus suggesting the abandonment of Poland and a general retirement on Brest-Litovsk, the Grand Duke placed a field army in defence of Warsaw, assisted by Japanese heavy artillery, and prepared a great counter-offensive from the north-west, under cover of the guns of Novo Georgievsk.

Hindenburg's main blow was delivered at Josefow, higher up the Vistula, with the intention of taking Warsaw in the rear. Ruzsky had been brought down to take command at Josefow, and here repeated the disaster which he had recently inflicted on the Germans at Augustovo. This time he lured the enemy across the river before falling on him in difficult country, and cut him to pieces. *Rennenkampf* was equally successful with the counter-attack from Novo Georgievsk, striking so hard that the German left centre was forced back from the Vistula with heavy losses. With both flanks turned—for Ruzsky had followed up his victory by himself crossing the river at Novo Alexandriev, and driving the Germans back first to Rudowa (15th Oct.) and then to Kielce (3rd Nov.)—Hindenburg had no alternative but to seek safety within the German frontier, and prepare another counter-stroke. The only success of the first advance on Warsaw was achieved by the Austrians under the Archduke Joseph Ferdinand and Generals Woytsch and Dankl, who succeeded in temporarily relieving Przemyśl and recovering Jaroslavl. Hindenburg's retreat, however, compelled them to withdraw in conformity to that movement. Przemyśl was again invested, the Austrians again fell back in Galicia, and the Russian advance on Cracow was renewed, the Grand Duke Nicholas having set his heart on reaching that convenient gateway both to Berlin and Vienna before the end of the year.

The second Russian advance on Cracow commenced with the second German advance on Warsaw, and both operations naturally reacted on each other. The Russians were at the very gates of Cracow by 5th Dec., but were then checked by an Austro-Hungarian counter-offensive which threatened both their flanks. The loss of the Dukla Pass (12th Dec.) forced a general retreat on this front, and was followed by the loss in turn of the Lupkow and Uszok Passes. By 20th Dec., however, the Russians, who had fallen back behind the River Nida,

turned on their pursuers and drove them north again until they were once more in possession of the Carpathian passes.

The Germans were no more successful in their second advance on Warsaw than the Russians had been in their march on Cracow. Hindenburg's urgent call for reinforcements, which had helped to relieve the pressure on the Western front in those critical days round Ypres, enabled him to attack all along the line on 18th Nov. The main assault was delivered by von Mackensen on the line held by Ruzsky from Gombin, on the Vistula, to Uniejov, on the Warta. Ruzsky's retreat to the Bzura in face of Mackensen's terrific onrush was one of the brilliant episodes of the war. It continued, with an increasing bulge, until Mackensen, on 23rd Nov., burst right through this and split it in halves. The halves held, and began to close up, with two German army corps all but bottled up within. But for some blunder in timing, for which *Rennenkampf* was held responsible, their only way of escape would have been cut off. As it was, after three days of desperate fighting, the German corps fought their way out—but only in remnants.

The Russians themselves had suffered heavy losses and were running short of ammunition, and when Hindenburg retaliated by blow upon blow in every sector, the Grand Duke Nicholas shortened his front, evacuated Lodz, and defended Warsaw from behind the Rawka and the Bzura. Here he sustained repeated onslaughts for nearly three weeks, the fiercest fighting taking place between the 10th Dec. and Christmas Eve against Bolimov and Sochaczew. In the end the Germans failed to hack a way through to Warsaw, just as they had failed a few weeks previously in their efforts to break through to Ypres and the Channel ports on the Western front. They were still 35 miles from the Polish capital at the close of 1914.

#### *Opening Campaign in Serbia*

In the meantime the Austro-Hungarian armies, which had somewhat atoned for their earlier failures by their successes in the recent advance which had temporarily relieved Przemyśl, were making little headway in their campaign against Serbia. That heroic little nation, though sadly depleted in her manhood by two years of Balkan warfare, was more than a match for her mightier neighbours in the opening stages of the European War. Austria's first punitive expedition, heralded by the bombardment of Belgrade on 20th July, was easily checked, the main invading forces being withdrawn to meet the new situation on the Russian front. Serbia and Montenegro thereupon invaded Bosnia, and an unproductive

campaign of withdrawals and advances led, towards the end of October, when Turkey threw in her lot with the Central Powers, to an Austrian invasion of Serbia in earnest. At first the Austrians, an army corps strong, and advancing in three columns, carried all before them. Valjevo fell on 20th Nov., and Belgrade ten days later. In withdrawing, however, the Serbians, ably led by the Crown Prince, Marshal Putnik, and General Mishitch, were falling back towards their bases and new supplies of ammunition; and in the battle of Rudnik, or 'Battle of the Ridges', which followed, turned on their pursuers and practically destroyed them. The battle lasted three days, at the end of which the remnants of the Austrian army corps, with the victorious Serbians hard on their heels, were in full flight to the frontier, leaving behind them 15,000 prisoners and 19 guns. All told their casualties amounted to some 80,000 and the bulk of their guns before the survivors were back in their own country, across the Danube, the Drava, and the Save.

#### *First Months of the War at Sea*

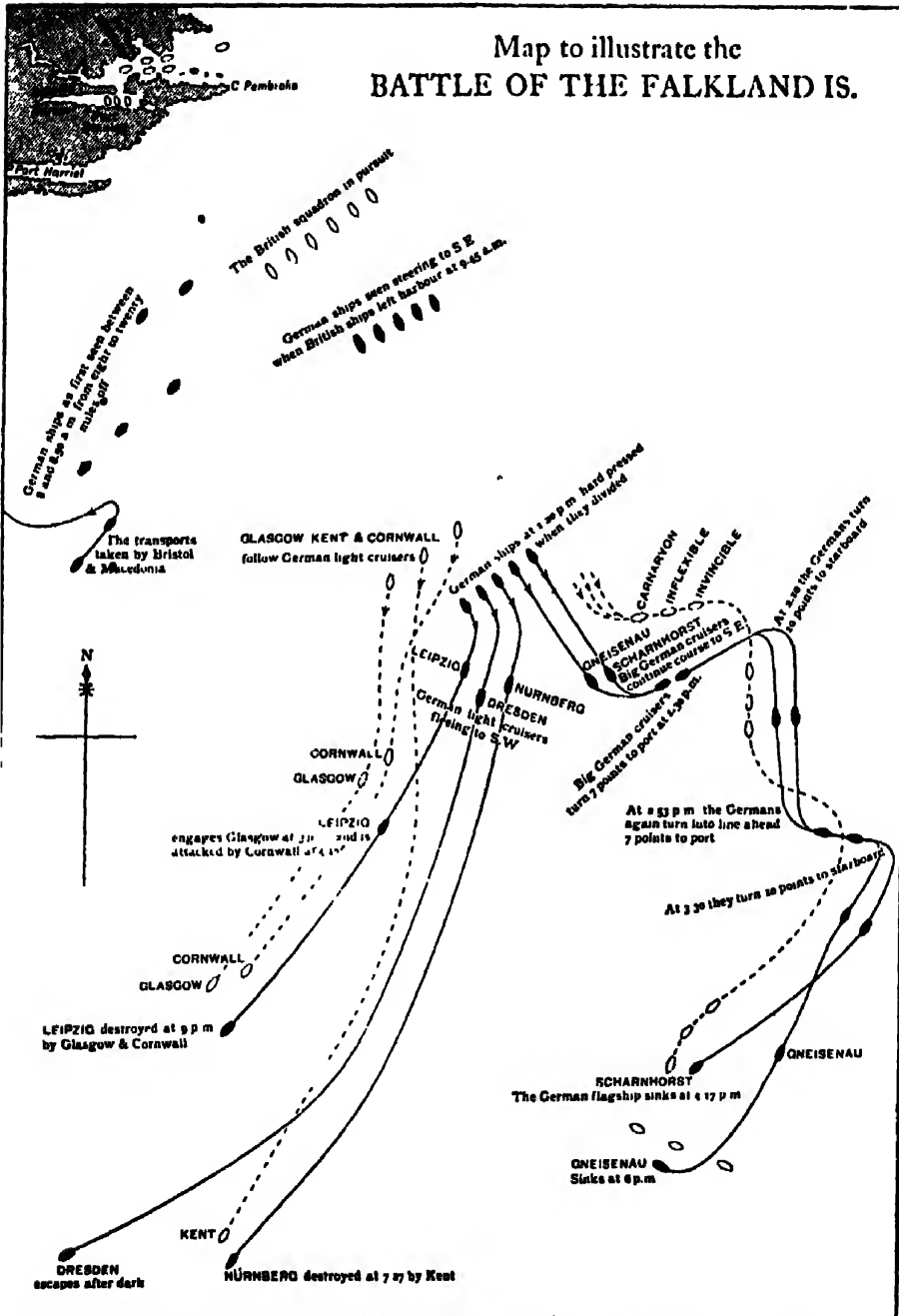
At sea the first months of the war had seen the Germans very discreetly sheltering in Kiel and Wilhelmshaven, leaving it to submarines, mine-layers, raiders, and a few commerce-destroyers to do as much damage as possible and reduce the disparity between its own force and that of the Allied fleets.

The first naval action of any importance took place in the Bight of Heligoland, on 28th Aug., when a force of destroyers, led by Commander Tyrwhitt in the new light cruiser *Arethusa*, with another light cruiser, the *Fearless*, and a flotilla of submarines under Commodore Keyes, served us a hire to draw out the Germans. They drew first a German force of destroyers and two cruisers (*Ariadne* and *Strasburg*) from Heligoland. The *Arethusa* greatly distinguished herself in the general engagement which followed, but, though she played the main part in driving the Germans back, she was so badly cut up that she had to be taken in tow at the end of the action. This was not until the Germans, deceived into the belief that the British ships were unsupported, sent out their heavier cruisers, the *Mainz*, *Köln*, and *Aurora*, just in time for Beatty's battle-cruisers, which arrived at the critical moment, led by the *Lion*, to settle the issue by sinking the three enemy cruisers above mentioned, besides a number of their destroyers. No British units were lost. Apart from this engagement the war in home waters for the next few months resolved itself into such isolated incidents as the sinking of the three old sister cruisers *Aboukir*, *Hogue*, and *Cressy* by the

German submarine commanded by Otto Weddigen (22nd Sept.); the destruction of four German destroyers by the British light cruiser *Undaunted*, supported by destroyers, on 17th Oct.; and raids by fast German cruisers on Yarmouth (3rd Nov.), on Scarborough, Whitby, and the Hartlepoons (16th Dec.), the first of which led to the loss of the German cruiser *Yorck* while crossing the minefield at Wilhelmshaven.

The scattered units of the German navy in other seas were gradually bottled up or destroyed. The Dreadnought *Goeben*, and the light cruiser *Breslau*, which were in the Mediterranean on the outbreak of hostilities, succeeded in evading the British fleet and reached the Dardanelles, where they played no small part in persuading the pro-German Turks, a few months later, openly to side with the Central Powers. Other German warships caught by the war in more distant waters included the light cruiser *Emden*, on the China station. The *Emden* disappeared for six weeks and then turned up in the Bay of Bengal, bombarding Madras on 22nd Sept., and capturing some twenty British steamers in the same month. On 28th Oct. she sank a Russian cruiser in Penang Roads, as well as a French destroyer, but twelve days later (9th Nov.) ended her eventful cruise off Cocos (Keeling) Islands, where she failed to destroy the cable and wireless station. The telegraphists on the island sent out a warning message which reached the *Sydney*, a British cruiser of the Australian squadron then escorting Australian and New Zealand troops to the war. Within three hours the *Sydney* arrived on the scene, and having the range of the *Emden* with 6-inch guns to 4-1-inch guns, forced the German cruiser ashore. After losing 7 officers and 104 men the *Emden*, burning and half-sunk, surrendered.

More dangerous than the *Emden* was the German cruiser squadron under Admiral Graf von Spee, which concentrated in the South Pacific from Kiao-Chau and elsewhere. The squadron consisted of the twin cruisers *Scharnhorst* and *Gneisenau*, each of 11,400 tons, 22 knots speed, and an armament which included eight 8-2-inch guns; and three smaller cruisers, *Dresden*, *Nürnberg*, and *Leipzig*, each of 3500 tons, and carrying ten 4-1-inch guns. On 1st Nov. von Spee fell in with the weak British squadron under Admiral Cradock, who had been sent in August to protect the South Pacific trade, and was expecting reinforcements to cope with the German concentration. Cradock's squadron consisted of old ships like the cruisers *Good Hope* and *Monmouth*; the light cruiser *Glasgow*, and the armed liner *Otranto*; the pre-Dreadnought battleship *Canopus*, which had been left behind for repairs, being some twelve hours away.





Outsteamed and outranged—though the *Good Hope* (14,000 tons) had two 9·2-inch guns on board—with the setting sun silhouetting their surfaces against the sky, they were no match for the Germans, who made the most of the added advantage which their inshore position gave them, obscuring their outlines when, as the fight began to fail, they drew nearer to Cradock's ships and opened fire. The *Good Hope's* two 9·2-inch guns could not find their target in the fading light, and were soon put out of action by von Spee's flagship, the *Scharnhorst*, whose eight 8·2-inch guns, like those of the *Gneisenau*, which meantime was engaged in a similar duel with the *Monmouth*, now had the British at their mercy. The 6-inch guns of Cradock's ships, almost awash in the rolling seas, were useless. At 7.50 p.m. the *Good Hope* blew up, but not before Cradock had ordered the *Glasgow* to get away with all speed and warn the *Canopus*. The useless *Orlando* had been ordered away before the battle opened. The *Monmouth*, after being silenced and set on fire by the 8·2-inch guns of the *Gneisenau*, was finally sunk by the *Nürnberg*. No survivors were picked up by the Germans, either from the *Good Hope* or the *Monmouth*. With Cradock perished in this naval disaster off Coronel some 1500 officers and men.

Meanwhile the *Glasgow*, making full use of her 25-knot speed, had warned the slow old *Canopus*, and together they made their way back to the Falkland Islands to await developments. Four days later Lord Fisher, who had just succeeded Prince Louis of Battenberg as First Lord of the Admiralty (20th Oct.), dispatched Admiral Sturdee with a squadron bent on avenging Cradock, and protecting the valuable base and coaling-station of the Falklands. Sturdee's squadron included the two first battle-cruisers built—the *Invincible* and *Inflexible*, each of 17,250 tonnage, with a speed of 27 knots, and eight 12-inch guns, besides sixteen 4-inch guns and five torpedo tubes. There were also four lighter cruisers—*Carnarvon*, *Kent*, *Cornwall*, and *Bristol*; and to these were added the *Canopus* when Sturdee reached the Falklands on 7th December. The *Glasgow* had already been picked up in the South Atlantic. The superiority both in number and weight of guns was now overwhelmingly on the side of the British.

Von Spee, who chafed to have suffered little loss in his victory off Coronel, had returned in the meanwhile to Valparaíso to refit, leaving again for the Falklands on 15th Nov. His programme apparently was to do as much damage as possible to the British base and coaling-station at Port Stanley; account for the *Canopus* and *Glasgow*, which he expected to find defending the port; and thence make

for South Africa in support of the rebellion there. Only some twenty-four hours before he approached Port Stanley Admiral Sturdee had arrived, and the news sent by the signallers on the island at 8 a.m., that the unsuspecting enemy was approaching, found the crews grimy from coaling, but alert and ready. Von Spee sent the *Gneisenau* and *Nürnberg* ahead to shell the wireless station, but a salvo of 12-inch shells from the *Canopus* in the harbour at 9.20 a.m. caused them to change their course. It was not, however, until 9.45 a.m., when the *Invincible* and *Inflexible* put out to sea with the *Glasgow* and *Kent*, that the presence of the battle-cruisers was revealed to them. It was then too late to escape. The German ships were no match for the British battle-cruisers either in speed or gun power. With the conditions of Coronel thus reversed, Von Spee, abandoning the attempt to run as hopeless, decided to end the fighting, and met his death as gallantly as Cradock had done some five short weeks before. Both the *Scharnhorst* and her sister, the *Gneisenau*, battered by the two British battle-cruisers, who were later joined by the *Carnarvon*, until they were mere helpless hulks, fought to the last before they capsized, the first at 4.15 p.m., the second just after six. Boats were ordered out to save survivors, and some 200 Germans were picked up from these and other ships that were sunk. The *Leipzig*, pursued by the *Glasgow* and *Cornwall*, kept up a running fight for three hours, and then, hammered to pieces, hauled her flag, but afterwards sank. The *Nürnberg*, after a longer chase, suffered a similar fate at the hands of the *Kent*, sinking an hour after surrendering. Only the *Dresden* escaped, seeking refuge at Junn Fernandez, but three months later she was called to account there by the *Kent* and *Glasgow* (14th March, 1915), when, after a five minutes' action, she was blown up by her commander.

With no enemy fleet at sea the task of the British navy was reduced to guarding British commerce from submarines and raiders, keeping watch and ward in the North Sea, and conveying troops to and from the widely scattered theatres of war. Every month added to Britain's commitments in various parts of the globe. All hope of an early peace had vanished by the end of 1914.

#### *Mobilizing the Empire*

Happily for the British Empire, Lord Kitchener had from the first anticipated a long-drawn struggle. His call for volunteers "for three years, or the duration of the war", showed how clearly he realized the gravity of the situation. One of his first demands had been for another half-million men to go on with, and history has recorded how nobly the young manhood of the

nation responded to his call. All the Dominions and Overseas possessions rallied to the Motherland with equal enthusiasm. We have shown how Indian troops—fighting for the first time on European soil—had already stepped into the breach on the Western front. The Canadians, nearest at hand, were the first of the Dominions to follow suit, but Australia and New Zealand, before their campaigns in Egypt and Gallipoli—and subsequently in France and Flanders—had already occupied Samoa, the Bismarck Archipelago, and other German islands in the Pacific.

#### *South Africa, 1914*

South Africa, on the outbreak of hostilities, had offered to carry the war into the German territory of South-West Africa, but General Botha had first to crush a revolt of Colonel Maritz's force; and this was succeeded by a more formidable rising in the Orange River Colony under De Wet, and in the Transvaal under Beyers. The response to Botha's call to arms proved the striking loyalty of the rest of the Union, and, with the force thus mustered the South African Prime Minister completely defeated the rebels before the end of November. De Wet was captured, and Beyers was drowned in attempting to escape. The colonial campaign which followed will be dealt with subsequently.

#### *1915 on the European Fronts*

*The Russian Campaign.* The heaviest burden of the war on the main fronts was now borne by Russia. Having failed to force a decision in the West, Germany looked to the Eastern front for compensating triumphs, confident that she could maintain her defensive positions against the Franco-British armies until such time as, with Austria-Hungary's help, she had brought Russia to her knees. It was also necessary to overawe Roumania and any other hesitating Balkan state that might be disposed to throw in its lot with Russia and her allies. Russia herself was provoking this reversal of German strategy by her renewed advances both on the Carpathian and East Prussian fronts. Hindenburg made two attacks on Warsaw early in the year (February and March), one by way of the Narew and the other by that of the Niemen, but both failed, thanks chiefly to the indomitable spirit of the Russian infantrymen, ill-equipped though they were. It was not until Mackensen's great 'drive' began on the southern flank in Galicia that Germany's new strategy revealed itself. Russia had then reached the culminating point in her military career. Besides holding up the German offensive in Poland, she had made herself mistress of all East Galicia,

Przemysl having fallen to General Selivanoff on 22nd March after an investment of five months, thus releasing 100,000 men to reinforce the armies under Ivanoff, Dmitrieff, and Brussiloff—then battling for the passes which led through the Carpathians into the Plain of Hungary. Przemysl alone yielded 126,000 Austrian prisoners, including the commander, General von Kusmanek, and 1000 guns. Between that period and the middle of April, when the Russians claimed possession of all the Carpathian heights along a front of 70 miles from south of the Dukla Pass to north of the Uszok Pass, another 70,000 Austrian prisoners were taken.

It was a dazzling, but an illusory triumph. The Russians had been deliberately led by the Austrians—under instructions from the German Higher Command—into their hazardous Carpathian adventure as part of the secret preparations for Mackensen's mighty blow elsewhere. Von Falkenhayn, then Chief of Staff, afterwards gave the credit for the plan to the German General Headquarters. Germany, with all her resources, was pouring out munitions of war far in excess of anything that the Allies could then muster, but been accumulating guns and ammunition for this purpose for months past, together with poison-gas and liquid-fire, and a total force of some 2,000,000 well-armed men. Russia, on the other hand, though she might oppose this force with fully as many men, was coming to the end of her resources, and her troops were ill-equipped to meet the massed guns of the artillery brought against them when the German planaux, after minor thrusts to left and right to cloak the real designs of the German Higher Command, began its overpowering advance on 1st May against the Dunajec lines, where Dmitrieff's Russian army believed itself securely entrenched. Mackensen's guns, opening up a way for the strongest army yet mustered under one general, blew the Dunajec lines to fragments. The Russian infantry clung to their positions to the last moment, but their rifles, often empty, were useless against high-explosive shells, or the waves of poison-gas which preceded the advance of Mackensen's shock troops.

On 5th May, with its front wholly turned, Dmitrieff's shattered army withdrew as best it could from the Dunajec lines to the San River. All Russia's gains in Galicia were destined to be sacrificed in similar fashion. Brussiloff's advance through the Carpathians was at once arrested; by 14th May, when Everts' army on the Nida had also fallen back, all the passes had been evacuated, though not without appalling losses. In the Bukovina, however, the Russian army under General Lerchitsky maintained a stubborn resistance south of the Dniester until 27th June,



when it fell back to the Gnila Lipa. It was high time to retreat. Przemyśl had again fallen into Austro-German hands (2nd June) as the first outstanding result of Mackensen's advance; Lemberg followed suit on 22nd June; and Halicz, abandoned by Brussiloff, fell on the day on which Lechitsky's army retreated from the Dniester to the Gnila Lipa. The end of June saw these positions abandoned and a further retreat in progress towards the line of the Lublin-Cholm railway.

Not cheaply were these spectacular triumphs won by the advancing armies of Mackensen and the Archduke Joseph Ferdinand. Their troops had been twice thrown back on the Dniester before that river had been finally won—a passage which cost them, all told, some 150,000 men; and in the successive retreats which followed, the Russian infantrymen turned repeatedly on their pursuers to prove that they were still capable of enforcing a price for every yard of ceded territory.

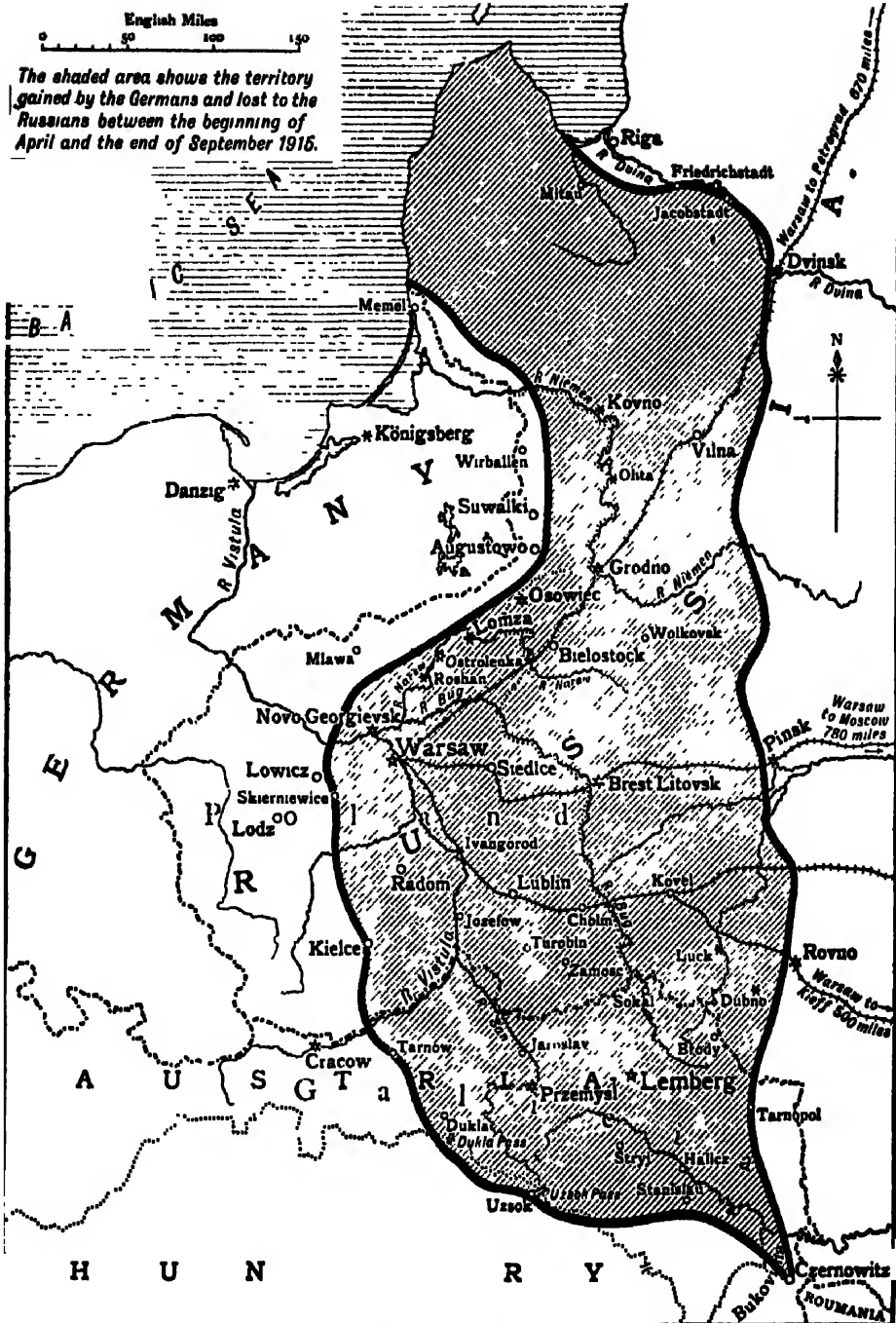
Mackensen's 'drive' was only part of the German Higher Command's plan for destroying the Russian armies in 1915. While the Austro-German phalanx was thus thrusting its way towards the Lublin-Cholm railway line, a simultaneous movement was in progress in the north, which had for its first objectives the great fortresses of the Polish salient, and Warsaw itself. Here Hindenburg, who was still in supreme command of the Austro-German forces on the Eastern front, had no longer General Ruzsky opposing him, Ruzsky having handed over the Russian northern command to Alexieff owing to ill-health. No matter how bravely the Russian infantrymen fought, or how ably they were led, they could not stand up against the hurricane of shot and shell which now blasted a path for the fully-equipped armies of von Below, von Elkhorn, von Gallwitz, von Scholtz, Leopold of Bavaria, and von Woyrsch. Prasnysh was won by von Gallwitz after a fierce battle in the middle of July, the Russians retiring to the shelter of the three fortresses guarding Warsaw from the north-east. Mackensen's advance to the south was resumed the next day, and the Grand Duke Nicholas, foreseeing the peril of this double threat, realized that his only hope lay in flattening the Warsaw salient and thus shortening his line. This sealed the fate of Warsaw, which was entered by Prince Leopold of Bavaria on 4th Aug. Ivungorod fell on the following day; Kovno on the 17th; Novo Georgievsk on the 19th. These losses, though deplorable, were not vital while the Russian armies still retained power to retaliate and recoup. Hindenburg strained every nerve to crush them once and for all. Ossowiec fell on 22nd Aug., the Russians resuming their retreat from the

Niemen and Bobhr. Brest-Litovsk had already been threatened by the converging movement of Mackensen and Prince Leopold of Bavaria. Seeing no hope of saving it in the face of the continued pressure, the Grand Duke Nicholas evacuated this most easterly of the Polish quadrilateral of forts on the 23th, having previously stripped it, as in the case of the other evacuated fortresses, of all war material.

Hindenburg strove to complete the discomfiture of the main Russian armies by a fresh advance on his extreme left, where von Below was ordered to push through Courland towards Riga, with Petrograd as the ultimate goal in the following year. On this front the Russians had already been forced to relinquish Memel, just across the German frontier, as well as Libau. German naval forces had shored in the operations on the Riga coast-line, and when von Below, after carrying Mitau, some 30 miles from Riga itself, met with prolonged resistance, they made an ill-fated attempt to capture the port from the sea. This was on 18th Aug., when the Russian fleet appeared on the scene while the German naval contingents were attempting to land in flat-bottomed barges at Pernau. The landing forces were annihilated, and the German ships beaten off with a loss of two cruisers and eight torpedo-boats. The Russians only lost an old gunboat in this one-sided action.

The naval operations, however, had little effect on the main issue. Russian fortresses continued for another month to fall like ninepins before the Austro-German armies. Grodno was evacuated at the beginning of September, and though General Kvertz escaped from Brest-Litovsk with his supplies and guns, he could not hold up Mackensen's irresistible march on Pinsk, even in the Pripet marshes, which were dry at that season of the year. Pinsk was occupied on 16th Sept. Nowhere was the pressure relaxed. In the south, where the flood-tide of the Teutonic advance had never set so strongly, the attack on the Volhynian fortresses had been vigorously opposed by Ivanoff; but Boehm-Ermolli entered Lutsk on 1st Sept., and the Austrians recaptured Brody on the same day.

The vital blow at this stage was being delivered in the north, where von Below, bent on reaching Riga for his winter quarters, was marching on the Dvina lines with the immediate object of crossing that river and turning the whole Russian front as far as Ivangorod. The extreme left flank of the Germans fought desperately for the Dvina crossing at Friedrichstadt, but failed to make it good, and the danger-point shifted towards Vilna, the ten days' battle for which was decided at Meisagowia on 12th Sept. Though two Russian divisions of the Imperial Guard were brought up to defend this key position, they were power-



### The German Slice out of Russian Territory at the end of the Summer Campaign of 1915

less to hold it against the great weight of German artillery. With its capture on 12th Sept., Vilna's fall became merely a matter of days. Before the Vilna armies could make good their escape, Hindenburg endeavoured to crown his triumph by outflanking them on both sides, von Eichhorn's cavalry sweeping round from Vilkomir in the north, and von Scholtz pressing forward, though less rapidly, on the southern side of the salient.

In this supreme crisis on the Eastern front, Ruzsky, recovered from his illness, returned to his command of the northern battlefields, and signalized his reappearance—not for the first time—by changing the whole complexion of affairs. Reinforcements enabled him in the first place methodically to evacuate the Vilna salient under their protection. Hindenburg endeavoured to counter this by rushing up cavalry reinforcements, with 140 guns, to support his outflanking thrust in the north, which, reaching Vidzy on the 16th and Vileika on the following day—this being well to the rear of the Vilna armies—threatened irretrievable disaster to the retreating Russians. They were saved by the series of flank-guafi battles securing their one avenue of retreat, and Ruzsky's counter-offensive from Dvinsk—a stroke so effective that the long German cavalry arm was in itself now in danger of being cut off. Vidzy was recaptured on the 20th; Smorgon, south of Novo Grodek, on the 21st; and Vileika before the end of the month.

On 15th Sept. Lord Kitchener had publicly declared that the Germans had "shot their bolt" on the Eastern front; and, so far as the immediate destruction of the Russian army as a force in being was concerned, this was true, though it was hard to believe while the wide sweep of the German advance was in full force. Ivanoff's reaction was equally marked in the south, where Brussiloff and Lechitsky took von Bothmer and Pflanzer-Baltin by surprise. Before the end of September the Austro-Germans had not only been pushed back to the Strypa, but had also lost both Dubno and Lutsk (23rd).

Germany's great summer offensive was over, but Hindenburg tried hard to secure good winter quarters in the north by a renewed advance on Dvinsk and Riga. A frontal attack was launched on Dvinsk on 3rd Oct. and was a costly failure. Ruzsky had defended Dvinsk with a semicircle of far-flung trenches on the Verdun model, against which the German shock-troops and guns could make practically no progress. After three weeks of vain endeavour Hindenburg shifted the attack to Riga, with no better success and heavy additional casualties. Thrust and counter-thrust succeeded one another with little change in the general situation until the end of November, when, after temporarily securing a crossing

at Dahlend Island, south-east of Riga, in the River Dvina, Hindenburg was forced to abandon the attempt as futile. With the help of their fleet the Russians won their way back to Kemmern; and in their counter-offensive from Dvinsk in the same month recaptured Illutsk. All hope was then abandoned by the Germans of taking either Riga or Dvinsk that year. The German effort in the south, below the Pripet marshes, also slackened. Ivanoff not only maintained the ground he had won, but scored several notable victories in the Strypa sector; but both here and along the Styra, where Lechitsky was opposing Bothmer, there was both give and take and nothing decisive—apart from the fact that Roumania was saved by this evidence of Russia's recuperative powers from choosing the wrong side.

In order further to influence the dubious attitude of Roumania, a fresh Russian offensive in the Bukovina was begun in the last days of the year, with Czernowitz as the objective; but as this rightly belongs to 1916 it will be dealt with in our summary of the operations for that year. Though Russia had not succumbed as a military power under the staggering blows she had received in 1915, she had lost 2,000,000 of her best fighting men, and the *moral* of her army was never so high again. Falkenhayn has hinted in his *Memoirs* that the Germans knew that the blind faith of the Russians in their rulers was already shaken before they started Mackensen's 'drive'. It could not be expected to endure in face of the criminal neglect and corruption which every day added to their hardships and losses at the front. The Russian court at that period has been described as a mixture of folly and intrigue, with 'dark forces' at work under pro-German influence, led by the impostor Rasputin. The Grand Duke Nicholas, who was above the treacherous influences now undermining all departments of the Russian system, had been transferred to the command in the Caucasus in the most critical hours of the Austro-German advance, the supreme command of the Russian armies being taken over by the Tsar himself (5th Sept.), with Alexieff as Chief of Staff. The Tsar's motives were above suspicion; but he lacked the efficiency and generalship of the Grand Duke, and stood for a system which, under the searching test of war, was proving itself unworthy of the continued sacrifices of his subjects. The sacrifices were repeated in 1916, but the seeds were already sown of the red harvest which was to lead to Russia's downfall and the end of the Romanoffs.

#### *The Balkans, 1915*

The progress of German arms in 1915 had decided Bulgaria to throw in her lot with the

Central Powers. Her price—fixed by secret treaty with Germany in July of that year—was the whole of Macedonia possessed by Serbia, and other valuable slices of territory. It was not until 12th Oct. that formal war was declared by Bulgaria against Serbia, five days after the fresh invasion of Serbia had begun under Mackensen's leadership, with two Austro-German armies, one under General Koevess, advancing west of Belgrade in a wide flanking movement along the old roads over the Save and the Drina, and the other, under General von Gullwitz, advancing east of Belgrade against the main Serbian forces. Against this new Mackensen 'drive', with fully-equipped forces larger than the whole Serbian army, organized with all the Teutonic thoroughness which marked the same leader's Galician triumph, the Serbians had no chance, though they fought, as ever, with stoic resistance, and exacted a price for every inch of ceded territory. While they were thus stubbornly retreating, Bulgaria threw in two of her armies on the Eastern front, thus threatening, with the advancing Austro-German forces, to enclose them in a wide loop. The tragedy of it was that Serbia's allies were powerless to save her; and that Greece, who by the terms of her treaty with Serbia should have gone to her assistance as soon as Bulgaria attacked her, declined through King Constantine to do so, notwithstanding the insistent advice of his Prime Minister, M. Venizelos. Convinced, like King Ferdinand of Bulgaria, that Germany was winning the war, King Constantine maintained to the end an attitude which, though he chose to call it neutral, was never friendly towards the Allies. Russia had her hands too full to go to Serbia's aid, and though a Franco-British attempt was made as the net closed round the encircled Serbians, it was too late to save the situation.

The story of the Serbian disaster of 1915, when the fall of Monastir on 2nd Dec. robbed the Serbians of their last stronghold, is that of a desperate flight across the frontier and over the mountains of Albania and Montenegro to the Adriatic. Thanks to the Serbians' heroic efforts, the Austro-German armies had not been able to close the net tight, and though the Bulgarians followed hard on their heels, they could not quite complete their victory. All told, however, the Serbians lost some 50,000 men, killed, wounded, captured, or starved, in the retreat, together with their guns and equipment. Their aged monarch shared the retreat and succeeded in reaching Brindisi.

Meanwhile the Franco-British force, which, as already related, arrived too late to prevent this final act of the Serbian tragedy, had established a strong base at Salonika, notwithstanding Greek protests on the grounds of neutrality.

It was not until 14th Oct. that the combined force, under the leadership of General Sarrail—the British column being commanded by General Mahon—began to move up the Vardar valley, the British advancing on the right towards Lake Doiran, and the French towards Strumnitza. Both forces were soon in touch with the Bulgarians, and fought a number of minor engagements in their forlorn hope of effecting a junction with the hard-pressed Serbians. Besides being too late, however, the Franco-British forces were not strong enough to effect their purpose, and when the remnants of the Serbian army had been forced across the frontier towards the Adriatic, they were themselves attacked by powerful Bulgarian columns. The object of his expedition having been eliminated, General Sarrail prepared for retreat to his base. The Bulgarians did their best to hurry his retirement. They launched a determined attack, which he repulsed with heavy loss; and then endeavoured to isolate the two columns by an assault on the British force at Lake Doiran. Though some 1300 casualties were sustained in defeating this attack, the British, acting as flank-guard to the French, enabled the retreat to be made jointly. By 13th Dec. the Allied troops, having administered a severe check to the pursuing Bulgarians two days previously, were across the Greek frontier in good order, and in due course had entrenched themselves about Salonika.

With the fall of Serbia came the collapse of Montenegro, in circumstances considerably less heroic than those which marked the Serbian retreat. The key position of Mont Lovtchen was abandoned to the Austrians with little if any show of resistance, and Cetinje, the capital, similarly entered by the invaders. King Nicholas of Montenegro sought refuge in Paris; Prince Mirko of Montenegro in Vienna.

The Serbian soldiers who survived the great retreat, numbering some 100,000 in all, were met on the Adriatic coast by units of the Italian fleet and transferred to Corfu—to rejoin and rest for the later campaigns which were to lead to the recovery of their country.

### *Italy, 1915*

Italy, whose warships were thus instrumental in saving the Serbian army, had thrown in her lot with the Allies by declaring war against Austria-Hungary on 23rd May, 1915. Austria had refused to offer adequate 'compensation' for her disturbance of the Balkans; and, moreover, the time had obviously arrived to complete Italian unity. A few weeks previously Italy had signed the Treaty of London, under which the Allies agreed to satisfy most of her terri-



torial ambitions when the time came to share the spoils of victory—an agreement which led to some of the most difficult problems in the final peace settlement. To Italy's honour be it added that she joined forces with the Allies when their prospects were none too bright, when they were able to report little or no progress either on the Western front or in Gallipoli, and Austro-German arms, on the other hand, were beginning to carry all before them in Mackensen's great drive in Galicia.

Italy was in no position to throw her whole weight into the struggle in 1915. Though her war strength was reckoned at a million men, her army was ill-equipped with guns, especially with modern heavy artillery and machine-guns, and her industrial resources were wholly inadequate to make good the deficiency. The mountainous frontier which she had to defend, too, gave every advantage to the Austrians. She succeeded in seizing three of the passes, the Stelvio, Tonale, and Giudriari, on the east side of the Trentino, and in blocking others on the west side, as the opening moves of her campaign, the object being to secure her flank in the subsequent offensive operations which aimed at Trieste by an advance across the Isonzo. Though these operations succeeded in pinning to the Italian front considerable forces of Austro-Hungarian troops which might have been thrown into the Russian furnace, the Italian effort fell far short of its objectives. General Cadorna, the Italian Commander-in-Chief, won a number of small successes in deploying his Third Army on the right bank of the Isonzo during June and July, securing the bridge-heads at Caporetto—the scene of Italian disaster two years later—Plava, Gradisca, and Monfalcone, thus holding the western bank of the river from Tolmino down to the sea. But the Italians were now faced with powerful defences, buttressed by the Carso Plateau in the south, which could only be carried at that time at prohibitive cost. All attempts to capture these strongholds broke down, and though a footing was gained on the Carso, and slight gains were constantly reported from the Trentino, the operations along the Italian front settled down before the year was out to the give-and-take fighting which characterized the siege operations in the West.

#### *Western Front in 1915*

On the Western front neither France nor Great Britain was ready in 1915 to undertake any advance comparable with the great offensives of the Central Powers in the East. Russia in her agony complained that France was not doing enough, but all the Allies' efforts this year were crippled by their inability to supply the

wholly unprecedented demands for munitions of war. Great Britain was still struggling months behind to catch up a foe who had been preparing for years. Mr. Lloyd George subsequently related how, in the month of May, 1915, when the Germans were turning out 250,000 shells a day, most of them high-explosives, Great Britain was producing a mere 2500 a day in high-explosives, and 13,000 in shrapnel. The French, accustomed to supplying the demands of armies on a Continental scale, had naturally done considerably better than this, but even their most strenuous efforts were inadequate to cope with the enormous output of the German arsenals. Mr. Lloyd George retired from the Chancellorship of the Exchequer in order to assume control of the newly created Ministry of Munitions, which in due course more than made good all these defects. That, however, was not in 1915. Up to the end of that year, according to Lord French, "the scanty supply of munitions of war paralysed all our power of initiative, and at critical times menaced our defence with irretrievable disaster".

At the end of the first long winter of dreary trench warfare the British Commander-in-Chief deemed it necessary to undertake an offensive in order to prevent the *moral* of his army from deteriorating. Hence the battle of Neuve Chapelle, which, begun on 10th March, was fought with a small reserve of ammunition accumulated for the purpose, and had to be broken off after three days' struggle through lack of further supplies. The troops chosen for the main assault were Rawlinson's Fourth Army Corps, with the Indian Corps on the right. Following the preliminary bombardment, they quickly overran Neuve Chapelle itself and made 1000 yards progress on a 3-mile front. But to left and right the attacks were held up, and two further days' fighting failed to add to the gains—purchased at the excessive cost of 562 officers and 12,239 men. The total German losses, including 1680 officers and men as prisoners, were estimated as rather higher than this, but the net result, though ranking as a British victory, was admittedly disappointing.

Earlier in the year Lord French had endeavoured to convince Joffre that the proper rôle for the British army to fulfil was an advance on the extreme north in co-operation with the British navy. Joffre was unsympathetic, though he held out hopes of co-operating in such an advance with the French army at a later date. His plan for the 1915 campaign was to break through the German line from the south at Rheims, and from the west at Arras. To do this he must mass as many French corps as possible behind these points, meanwhile keeping the enemy busy elsewhere in order to prevent

him from reinforcing the threatened positions. This general strategic idea, as Lord French has pointed out, was the foundation of all the Allied efforts in the West throughout 1915. It led to numerous local successes along many parts of the line, but no real advance was made towards the main objectives. These were not defined until the combined offensive was launched in September.

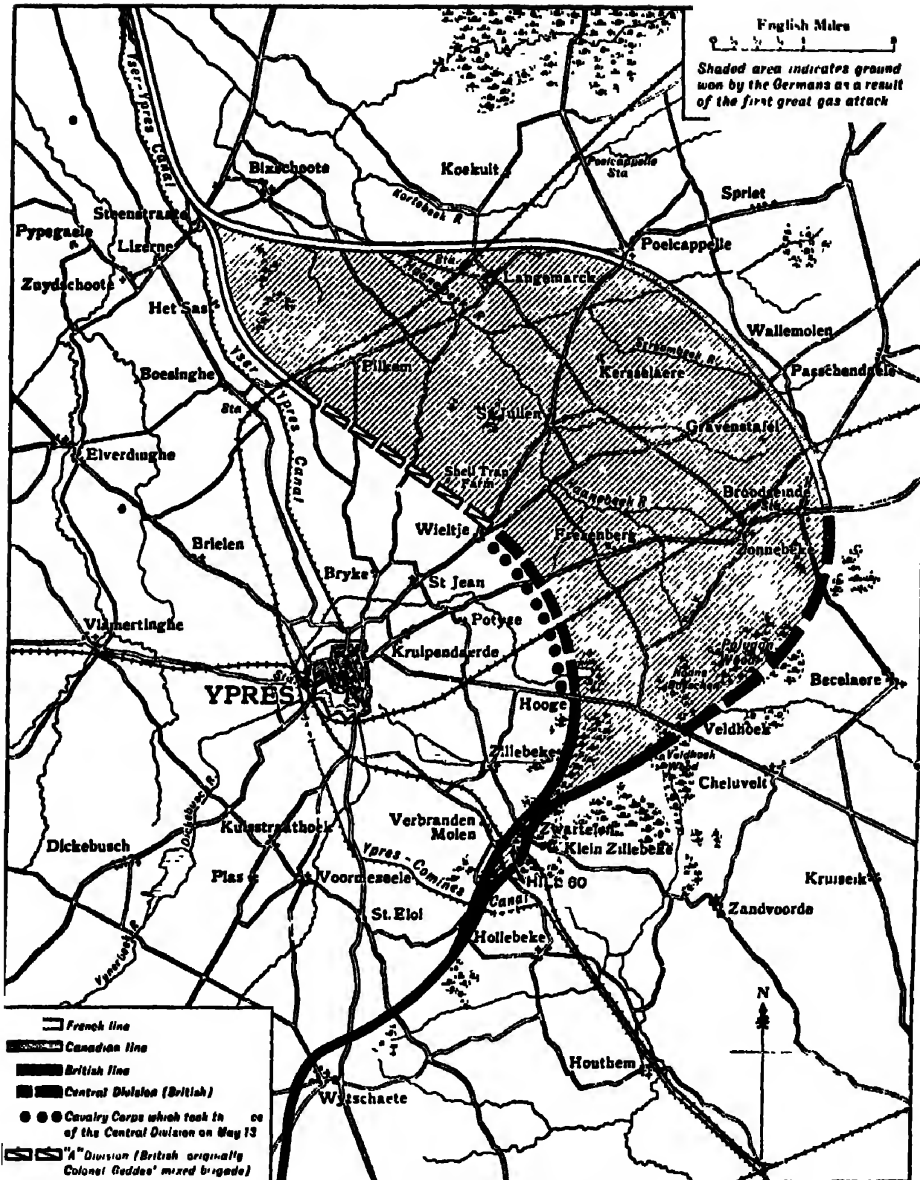
The Germans themselves, though content to leave to the Allies most of the attacking in the West in 1915, maintained a sufficiently active offensive-defensive. While the French in Alsace were making a fresh advance on Mulhouse at the beginning of the year, they counter-attacked at Soissons, after bombarding the cathedral on 9th Jan. It was only after a week's desperate fighting and heavy French losses—including a bridge-head on the Aisne—that they were checked. In Champagne the French managed to capture Perthes (8th Jan.) and strove valiantly but vainly to wipe out the St. Mihiel salient. The most ambitious effort of the opening months of the year was the British offensive at Neuve Chapelle, which, as already pointed out, failed largely through lack of ammunition. In his report on that battle the British Commander-in-Chief referred to the pressing need of "an almost unlimited supply of ammunition"; and the lack of it was the real explanation of the Allied failure in 1915.

Germany knew well enough how matters stood in this respect, and added ruthlessly to the handicap which their own superior supplies gave them by suddenly attacking with chlorine gas—the first use of poison-gas in the war. This was on 22nd April, following a grim struggle south-east of Ypres for 1111 60, the flattened remains of which, after five days' incessant fighting, remained in British possession. Having been careful beforehand to accuse the French of using poison-gas near Verdun on the 14th—a charge without justification—the Germans launched it in dense volumes from pipes previously laid down for the purpose north-east of Ypres. The attack was preceded by a heavy bombardment, the gas-clouds following at 5 p.m. on the 22nd. The Allied line was held at this point by French Colonial and Territorial troops, with the Canadian Division on their right. All unprotected as they were against this diabolical form of warfare, the French troops, gasping for breath, broke and fled. Many fell asphyxiated. With a gap in the Allied line 5 miles wide, the Canadians suddenly found their flank left in the air. Less affected by the gas than the French, they were chiefly instrumental in saving the situation by a valiant resistance until reinforcements could be sent to fill the gap.

The gap was evidently wider than the Germans

either anticipated or realized; otherwise the disaster might have been irretrievable. As it was, the situation remained precarious until the 27th, when a counter-attack in conjunction with the French recovered some of the ground, and a large portion of the sorely tried Canadian Division was relieved by the Lahore Indian Division. Altogether seven British divisions were involved in this hard-fought battle, the net result of which was to bring the Germans 2 miles nearer to Ypres on a 5-mile front, and to give the Allies a worse line to hold. Eight batteries of French field-guns were lost and four British guns of position. These last were recaptured by the Canadians, but the enemy had already destroyed them. In all the Allied casualties amounted to nearly 25,000. The Germans estimated theirs at 16,000. In his report on the gas-attack Sir John French declared that protest against this form of warfare would probably be useless, and Lord Kitchener intimated in the House of Lords on 18th May that retaliation might be inevitable. Respirators more or less effective were supplied to the troops, and the use of poison-gas, followed by liquid-fire—another German innovation—became permanent additions to the horrors of modern warfare.

Before the new battle round Ypres died down—it lasted, indeed, until the end of May—the storm centre shifted to the southern end of the British line, where it joined hands with the French left. Here General French began the battle of Festubert, undertaken to relieve the intense pressure on the troops at Ypres, but also serving as part of Joffre's general plan of attack in the direction of Lens and Lille. British and French alike were hunched against the German lines on 9th May, the British taking the offensive between Rougemont and Givenchy, and the French between Neuville St. Vaast and Notre Dame de Lorette. The renewed struggle for Ypres, however, had drawn heavily on the scanty British reserves of ammunition, and the preliminary bombardment of forty minutes proved wholly inadequate to crush the resistance offered by the enemy's numerous fortified posts when the First Army advanced to the attack. This disastrous engagement, in which the greatest bravery was displayed against overwhelming odds, cost over 12,000 casualties. It achieved nothing in the field, but the lessons which it taught led to the formation of the Coalition Government, with Mr. Lloyd George as Minister of Munitions. The second stage of the battle of Festubert, which began at midnight on 15th May, was more successful, the enemy's front-line trenches being captured on a front of 3000 yards; but the losses incurred in winning and holding the positions were disproportionately high.



**'The Ypres Salient before and after the Second Battle of Ypres, 22nd April-13th May, 1915**

The French effort began more auspiciously as a result of the longer and more intense bombardment which preceded their attack on the 9th, but the series of minor successes which they won round Souchez, after weeks of incessant fighting, made little real impression on the defences of Lens. The truth was that Germany had so expanded her war-material factories that, with the aid of the Austrians, she could turn out sufficient shells and guns for her main offensive on the Eastern front, and at the same time overweight the Allies in the West.

Throughout the summer the line, though never quiescent, and often breaking out in furious bombardments, minor attacks and counter-attacks, and raids on both sides, remained little altered. The hardest fighting of all was round the war-scarred salient of Ypres, still held, as in the first gas-attack, by the Second Army, to which some of 'Kitchener's Men' were now attached. It fell to this advance-guard of the New Army to bear the brunt of the first attack on the British with liquid-fire, the Germans, who had already used this new device of the *flammenwerfer* against the French, employing it in another desperate assault on the British lines round Hooge. The New Army units fought with almost incredible gallantry, but were blinded by the unexpected, burning sheets of flame, and while they were still blind the enemy charged and took the first-line trenches on a front of some 500 yards. The losses were avenged on 9th Aug., when the 6th Division recovered all the captured positions, and 400 yards of German trench into the bargain.

With the arrival of the reinforcing British divisions of the New Army, General French was able to take over some 17 miles of additional front, the British line thus extending over about 50 miles, with the Belgians on the left holding the remaining 18 miles to the sea. This still left the French army 500 miles to hold, from the British right to the Alps.

The summer of 1915 passed away without any great offensive on either side. The Germans, now at the flood-tide of their sweeping advance against Russia, were content to continue their vigorous offensive-defensive in the West. Besides the fighting already referred to, there was incessant warfare in the Argonne Forest, where the German Crown Prince was noisily active throughout the summer, threatening Verdun, but making no serious advance. The French continued the deadly trench-to-trench warfare in the Souchez area and the 'Labyrinth' region nearer Arras, and steadily tightened their hold on the reconquered corner of Alsace, consolidating their positions on the Hartmannswillerkopf, which had been the scene of continuous fighting in the renewed advance towards Mulhouse. For the

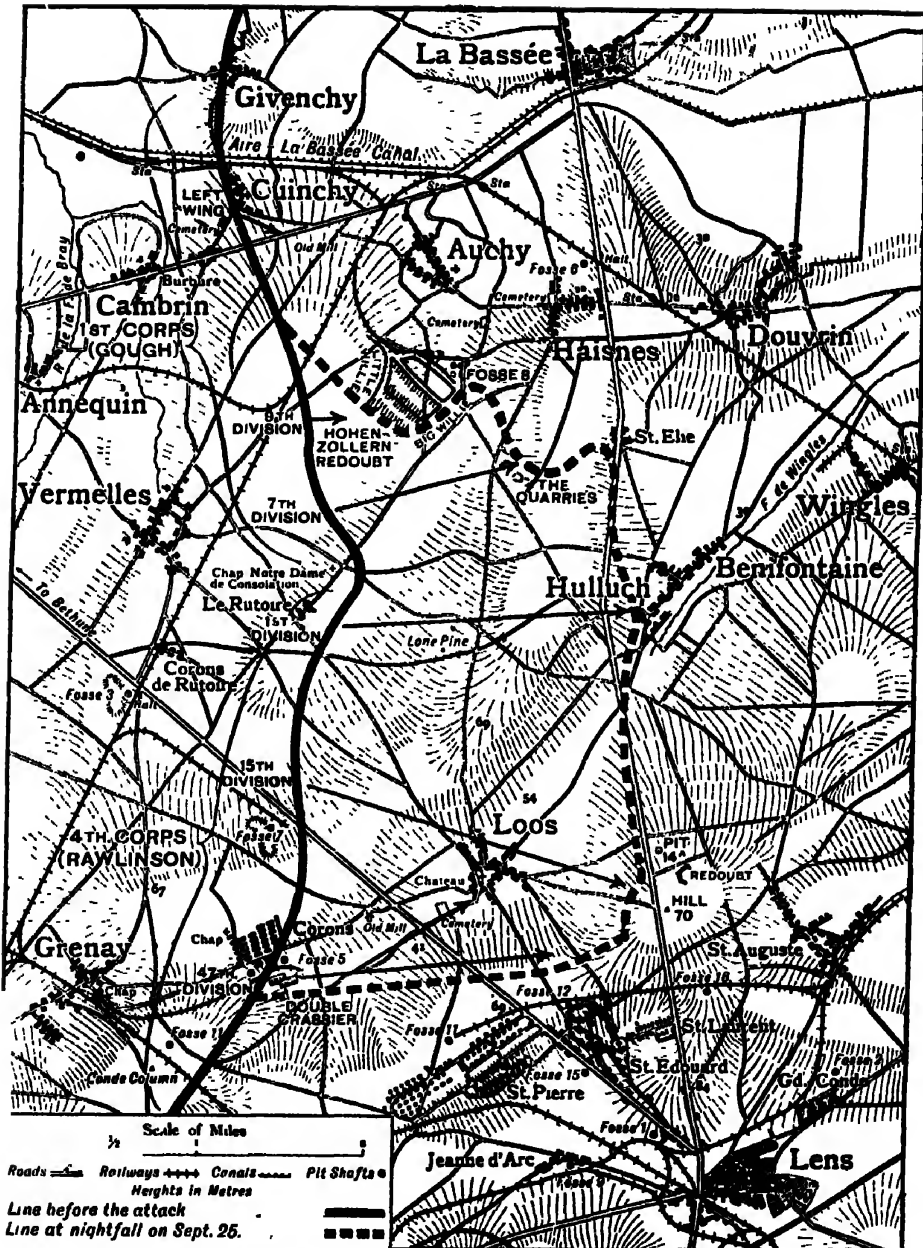
most part, however, the French, like the British, were now storing up reserves of ammunition and completing their dispositions for the joint offensive planned for the autumn, when the main objects of Joffre's general strategic idea for 1915 were for the first time clearly defined, though unattained.

A great Allied offensive in the West had become increasingly necessary in view of the prestige gained by the Central Powers, not only by their tremendous advance into Russia, but also by the Allies' disastrous campaign in Gallipoli, where the failure of the Suvla Bay landing—subsequently dealt with in our account of the operations against Turkey—had just given the enemy additional cause for rejoicing. Joffre's plan of attack, designed "to drive the Germans out of France", was not ripe for execution until towards the end of September. Even then, though General French had for months been gradually accumulating troops and ammunition for the blow—the British army now numbering nearly a million men—full strength in both respects was still only half developed.

There were two main assaults in the combined offensive, launched on 25th Sept., 1915, the chief of which was in the French centre in Champagne, where de Castelnau, Joffre's right-hand man, attacked with Langue de Chèvre's Fourth Army on a 16-mile front between Auberive and Massiges, the object being to force the Germans back on the Aisne, and, if possible, cut off the army of the German Crown Prince in the Argonne. Second in importance was the Franco-British advance on the same day in Artois, General French's object being to push through between Lens and La Bassée on the north, while Generals Foch and d'Urbal, on his right, stormed the Vimy heights and attacked Lens from the south. Secondary operations were carried out at various other points in order to distract the enemy's attention, feint attacks being made by Sir Herbert Plumer with the 5th Corps—part of the Second Army—east of Ypres, where Bellewarde was temporarily taken; as well as by those units of the First Army occupying the line north of the Béthune-La Bassée Canal. Similar demonstrations were made at Bois Grenier, and along the slopes of the Aubers Ridge, where British and Indian troops alike fought heroically for ground which, though captured in the first onrush, could not be held under the powerful fire concentrated against them.

#### *Battle of Loos*

The main British attack was delivered by the First Army under Sir Douglas Haig along a front extending from La Bassée Canal in the north to the mining village of Grenay on the



Map showing approximately the battle-lines of the First Army under Sir Douglas Haig at daybreak and at nightfall on 25th September, 1915

south, and is conveniently named the battle of Loos. The task of the 4th Corps (Rawlinson), with the 47th (London Territorial) Division on the right, the 15th (New Army) Division in the centre, and the 1st Division on the left, was to carry, as its first objective, Loos and the heights between Lens and Hulluch. The 1st Corps (Hubert Gough), with the 7th Division on its right, the 9th (New Army) Division in the centre, and the 2nd Division (Horne) on the left extended to the canal, was to link up with the Fourth Army at Hulluch, taking in its stride the Hohenzollern Redoubt and the formidable German fortresses in the Quarries and Fosse 8. Had this general plan succeeded, and the Tenth French Army on the British right advanced in line with it, a great gap would have been made in the German positions in Artois, which, with a similar success from the mightier French blow in Champagne, would at least have brought relief to the hard-pressed Russians in the East, if it did not achieve all that Joffre had hoped for it. As it was, the Allied victory, both in Artois and Champagne, fell far short of its aims, and, save for insubstantial advances, was fruitful chiefly in bloody experience.

An intense bombardment for four days preceded the main British advance, and was followed by a gas-attack—used by the British on this occasion for the first time.<sup>1</sup> Many parts of the German defences along the 7-mile front, however, were far from obliterated when the infantry advanced to the attack, especially on the left, where the 2nd Division was held up by impassable wire defences. The 9th Division had a similar experience on its left wing, where the undemolished defences of the Hohenzollern Redoubt became a veritable shambles. On its right, however, the leading Scottish battalions scored a fine success in reaching Fosse 8. On their right the 7th Division did equally well, capturing the Quarries and reaching Cité St. Elie, north of Hulluch, though subsequently forced to rest on the Quarries. In the meantime the 4th Corps, like the 1st, had been repulsed on the left and victorious on the right. Held up on the left by unbroken wire and undamaged German defences, the 1st Division could make no appreciable advance on the Lens-Hulluch road, thus exposing the left flank of the next division in line—the 15th (Scottish). The Scotmen on their part had made a magnificent advance, first sharing with the Londoners of the 47th Division the honour of capturing Loos, and then rushing on impetuously to Hill 70, and beyond as far as Cité St. Auguste, on

the outskirts of Lens. Had reserves been available at once to consolidate the gains thus won, Lens itself might have been taken, and a door flung open leading to Lille. But as it was impossible to say at which part of the long British line they would be needed, Sir John French had retained his reserves far in the rear. When at last they were forthcoming—the new 21st and 24th Divisions, hitherto untried—they were put into the battle-line after nightfall, tired and hungry after a heavy 8-mile march.

It was impossible to hold all the ground won during the day. Without reinforcements, and no sufficient artillery support, the 15th Division had already been forced to relinquish its hold on Cité St. Auguste, and fell back to the western slopes of Hill 70 on the Lens-Hulluch road. Misdirected and drenched with rain, the two tired reinforcing divisions could do little to help amid the confusion of the battlefield. Their supporting attacks at various points broke against the still intact German wire or simultaneous counter-attacks by the enemy. One brigade alone (the 72nd) lost 78 officers and 2000 men out of the 3000 with which it started. Altogether the losses of these two divisions amounted to 8000. Along the southern section they succeeded in maintaining contact with the 47th Division, and in the north helped the Scots of the 9th Division to maintain their hold on Fosse 8; but the Quarries, close by, were lost, and along most of this northern front the day's gains were gradually whittled away.

Another heavy handicap was the fact that the French Tenth Army, on the right of Rawlinson's Corps, had to postpone its advance until one o'clock in the afternoon—the British attack had been launched at 6.30 a.m.—and then was forced to direct the corps operating on its left in a south-easterly direction. This involved a considerable gap on the British right, when Rawlinson's men made their victorious advance. The Londoners of the 47th Division, however, not only held on to Loos, but formed a strong defensive flank which averted what might have been a complete disaster. Apart from the captured positions, 57 German officers and 3000 other prisoners had been taken during the day on the British front, together with 20 field-guns and 40 machine-guns.

On the following day the Germans counter-attacked in force and recovered Fosse 8, but on the 27th the Guards Division, under the Earl of Cavan, was sent forward and almost restored the earlier gains, including Chalk Pit Wood and the slopes of Hill 70. It cost the Guards 3000 casualties to make good the restored British line. They continued to hold it until the end of the month, when they were relieved. The 15th (Scottish) Division had also been with-

<sup>1</sup> The use of gas, as already pointed out, had been forced on the British by its adoption by the Germans. Ultimately the methods invented by British chemists and physicists outgassed the Germans.

drawn, after suffering no fewer than 8000 casualties. All told, the British losses in the battle of Loos amounted to 50,000 men and 2000 officers, including three divisional commanders—Major-General Sir Thompson Capper (7th Division), Major-General G. H. Thesiger (9th Division), and Major-General F. D. V. Wing (12th Division)—each of whom was killed. A series of costly counter-attacks on the enemy's part failed to make much impression on the new British line, and mounted up the German casualties until they were estimated at many more than those of the British. The battle died down; the guns were consolidated; but the murderous struggle at close quarters for the Hohenzollern Redoubt and its adjoining entrenchments continued for weeks and months, an outstanding feature of which was the attempt of the 46th (North Midland Territorial) Division to carry the redoubt by storm on 13th Oct. The Midlanders' task was handicapped, like so many British operations at this period, by inadequate artillery preparation, and though they fought like veterans they could only win the western side of the stronghold at a cost of 4000 casualties.

The advance of the 10th French Army on the right of the British was held up in front of Souchez on the opening day of the combined offensive, but made better progress on 26th Sept., when d'Urbal's troops made themselves masters not only of long-contested Souchez, but also of Thelus, La Folie Farm, and most of the Givenchy Wood. But the Vinny heights, notwithstanding that some progress was made along their slopes, still barred the road to Lens from the south. On the 28th the French 9th Corps, at the British Commander-in-Chief's request, took over the defence of Loos, and the British line was rearranged.

The main French effort in 1915, as already pointed out, was in Champagne, where a solid week's bombardment paved the way for the great advance on 25th Sept. Inspired by Joffre's stirring Order of the Day, "Remember the Marne: Conquer or Die", the French troops carried all before them on the greater part of the front. General Marchand's Colonial Division broke clean through 2 miles of the main German defences, Marchand himself falling severely wounded at the head of his men. The greatest advance was made on Marchand's right, from Navarin Farm to the Butte de Tahure, where an advance of 2½ miles was made before the day closed. But the troops in the centre were robbed of decisive victory by a double check on the wings. On the right the two German strongholds at the Butte de Mesnil and the Main de Massiges—comparable with the Hohenzollern Redoubt in their strength—held out stubbornly until, after days and nights of ceaseless combat,

both fell into the attackers' hands. On the extreme left the assailants could make practically no headway.

Thenceforward the French advance made little progress towards the main objectives, though a breach was made in the enemy's second line in a fresh attack on the 29th; and a third advance (6th Oct.) won the village and Butte de Tahure. On 20th Oct. the Germans recovered the Butte de Tahure, and in other counter-attacks prevented the French from developing their first initial advance into the greater victory which Joffre had hoped for it. The battle had yielded an impressive list of captures—the total number of German prisoners being over 23,000 before the end of September, and the captured guns 80—but the Allies' long line had not materially altered before the autumn offensive gave place to another winter of tedious siege warfare.

The year closed with the appointment of Joffre as Commander-in-Chief of all the French forces, General de Castelnau taking over the immediate command of the French troops in France; and the resignation of Sir John French—now created a Viscount of the United Kingdom, and appointed to the Home Command—after more than sixteen months of severe and incessant strain at the front. Lord French was succeeded by General Sir Douglas Haig, who had been singled out for promotion by his brilliant achievements since the British army first landed in France.

#### *The Naval War in 1915*

Throughout 1915 the operations at sea contained no movements so striking as some of those which marked the opening months of the war. The careers of all the scattered German cruisers were over, the last of them, the *Königsberg*, being finally destroyed in the Rufiji River, German East Africa, by the shallow-draught monitors *Severn* and *Mercey*, sent out for the purpose from Great Britain. The German High Seas Fleet remained in harbour, waiting for Lord Jellicoe to be tempted or goaded into some imprudent disposition of his forces. Hence the sudden raids on the British East Coast, begun in the closing months of 1914. They repeated them once too often, on 24th Jan., 1915, when the raiders, consisting of 4 battle-cruisers, 6 light cruisers, and a force of destroyers, were encountered off the Dogger Bank by the British battle-cruiser squadron under Admiral Beatty, consisting of the *Lion*, *Tiger*, and *Princess Royal*, as well as the *New Zealand* and *Indomitable*, and the light cruisers *Southampton*, *Nottingham*, *Birmingham*, and *Lowestoft*, together with the *Arethusa*, *Aurora*, and *Undaunted*. Outmatched by the 18·5-inch guns of Beatty's 'Cat' Squadron



of battle-cruisers, the Germans made for home. In the hot chase which followed, the *Blücher*, last in line of the German battle-cruisers, was hit repeatedly, fell behind, and was eventually sunk by a torpedo from the destroyer *Mekor*. Her survivors were picked up by the *Arethusa*. Beatty's flagship, the *Lion*, which was leading the pursuit, was partly disabled by a chance shot and had to be towed home, Beatty himself following the chase at some distance in a destroyer. Before he could pick up his place in the pursuit he met his three battle-cruisers returning, these having broken off the action owing to the increasing risk of straying into an enemy mine-field or of falling foul of the mines which the retreating Germans were strewing in their path. Two other German battle-cruisers had been set on fire by the British shells, the *Seydlitz* and the *Derfflinger*, but, with the rest of the German ships, they made good their escape. Taught by this experience, the Germans made no further naval raids on the East Coast.

In the following month (4th Feb.) Vice-Admiral von Pohl, Chief of the German Admiralty Staff, proclaimed a submarine blockade of the whole of the British Isles, declaring all the waters round Great Britain and Ireland a military area in which Allied merchant-ships were to be destroyed and neutral ships would incur danger of running the same risk. If the Germans thought they could scare British shipping away by these means, they were soon undeceived. They took heavy toll of peaceful shipping from the first, and shocked the rest of the world by the lengths to which they were prepared to go in developing this ruthless policy, but all their efforts failed to paralyse British trade as they anticipated. The crowning tragedy of this submarine campaign was the sinking of the Cunard liner *Lusitania* off the south coast of Ireland on 7th May, 1915, with its loss of upwards of 1000 non-combatants, including over 100 Americans. It was one of the German crimes against humanity in general and Americans in particular which brought the United States into the war on the side of the Allies in 1917.

#### 1916 on the European Fronts

*The Western Campaign.*—During the year 1916 the unity of command which was postulated as an indispensable preliminary to the victory of the Allies so long before it became a fact was achieved neither as between Britain and France in the West and Russia in the East, nor even as between Britain and France along the Western front. The most that can be said of the co-ordination between the forces under the British and French Commanders-in-Chief is that liaison was established between them, and

that as far as was possible each endeavoured to help the other by diverting to itself the energies of the German forces. The Western fighting embraced two main episodes: the powerful German attacks on Verdun, eventually unsuccessful; and the Allied offensive on the Somme, in which by far the greater share was borne by the British.

The year began with numerous German attacks widely separated in locality, and intended to mask the main offensive while keeping the French and British occupied. Hartmannswillerkopf, in Alsace (2nd to 8th Jan.); Champagne (9th Jan.); Givenchy, Arras, Neuville, Loos (14th Jan. to 6th Feb.); Vimy Ridge, Frise, Soissons, Ypres-Comines area, and Tuhure (9th to 20th Feb.) were among them.

On 21st Feb. the new battle of Verdun began. This enterprise, though officially accredited to the German Crown Prince, was the design of General von Falkenhayn. Verdun was one of the four fortresses, of which the other three were Belfort, Toul, and Épinal, on which French armies defending the capital and the country from an invasion from the east would base themselves. The town lies sunk in the Meuse valley, and the German invasion in 1914 slowed past it along the heights of the Meuse down to St. Mihiel. At the beginning of the war Verdun was protected by an outer line of forts, with batteries pushed out in a circuit of 90 miles. The forts were not, however, strong enough in 1914, nor the perimeter of defence extended enough, to withstand the new artillery that had reduced Liège and Namur, and a fierce struggle went on during 1915 along the Meuse heights on the east of Verdun and beyond the low hills on the western side of the town and river, with a view to pushing out the defences all round. As previously pointed out, much had been done in this direction by General Sarrail, but not enough to deter von Falkenhayn and the German General Staff from selecting Verdun as a point for an attack which, if successful, would disorganize seriously the continuity of the French defences. In 1916, as for two years more, the problem of either combatant was to break through a line of trenches which extended continuously from the sea to Switzerland; and failing a complete break-through, comparable to that which had crippled Russia in 1915, to effect a fracture or a deep dent which would compel the loser to reconstruct his system of communications. At the best such a thrust might disclose a fatal weakness in the assailed; at the next best it would disastrously hamper his future activities.

Verdun as a fortress had strong and modern defences. West of the Meuse, north of the town, are low hills the chief of which is the Charny Ridge with dominating strategic points beyond

known as Hill 304, Hill 295, Hill 205. The French lines were pushed beyond these into the woods of Avocourt and Forges, but below the heights of Montfaucon, which were the Crown Prince's head-quarters. On the east of the Meuse the heights rise to a tableland severed by wooded ravines and overlooking the plain of the Woëvre. The line of French trenches embraced all this tableland and a good deal of the plain beyond. Its outer line ran in a bold convex curve from Forges and Consenvoye on the Meuse to Fresnes on the Woëvre, but it did not penetrate the woods of Forges or Spincourt, and it was below the gun positions on the hills of Ornes. Inside this outer circle was the inner line of Samogneux, Beaumont, Fosses Wood, and Bezonvaux. Inside that again the line of Bras, Douaumont Fort, Harcourt Wood, Vaux Fort, and Elix.

The multiple defences were most elaborate between these two inner lines. A weak point was that though such defences would be very exacting of life and effort, yet the outer ones were not pushed out far enough to place the bridges of the Meuse out of reach of long-range gun-fire; and an overwhelming attack might have jammed a defending army on the east of the Meuse against the river. The French had provided against the possibility by the multiplication of transport, as well as of inner defences. The Germans hoped by the weight, volume, and suddenness of their attack to bring about the not impossible catastrophe. They massed an amount of artillery which, though surpassed afterwards in the war, was at that time the greatest assemblage that had ever been seen together, and accumulated a supply of ammunition exceeding the quantity which all previous experience prescribed. The heavier guns were placed at Ornes, Spincourt, and Forges. The woods below afforded cover for a concentration of men; and this concentration, amounting to fourteen divisions, with others in immediate reserve, was at first thrown at the 7-mile sector from Brabant-sur-Meuse to Herbebois, which was held by three French divisions under General Humbert.

The attack began on the morning of 21st Feb. with an artillery bombardment lasting four hours. The great weight of shell demolished the French first-line defences, so that the German troops had little to do but walk over them, while a remnant of the defenders fell back to their supporting positions. These were not sufficiently strong or well constructed to enable weak forces to hold them long against the force of three army corps (18th, 8rd, and 10th, with a Bavarian Division) which the Germans sent in after the guns had done their work. The effectiveness of the German artillery was due

in part to its weight, and in part to the fact that French counter-battery work effected little, owing to the thick weather.

The trench systems in the Haumont and Caures Woods were carried, but the resistance of parts of the first line at Brabant, Herbebois, and elsewhere was even at this dangerous moment reducing the speed of the German advance, though the momentum was far from exhausted. It was not till next day that the first line was definitely abandoned by the French; and on 23rd Feb. the line Samogneux-Herbebois was temporarily held. Before the morning of 24th Feb. the French contracted their line still further by drawing in their outposts from the Woëvre. It seemed a matter for surprise at the time that no flank attack was made by the Germans in the Woëvre; it had been perhaps thought an unnecessary extension of their general scheme, though the weather, which was bitter and snowy, was unfavourable for operations in that sodden plain.

But the German second wave of attack was now rising in fury, and General Pétain, who had undertaken the command of operations on the French side, was still awaiting reinforcements. The character of von Falkenhayn's attack had become clear, and while to the French the need for holding on was imperative, the Germans had a need no less urgent for hastening operations and exploiting their preliminary success to a point at which General Pétain could not repair the breach. They had, in fact, two days in which to achieve their aim—24th and 25th Feb. On the 24th they flowed round the Beaumont Woods and came close to the Talou Ridge, the Poivre Ridge, and the rest of the French line where it ran past Haudremont and Douaumont to Vaux. On the 25th they attacked the Poivre Ridge without much success, but pressed the more important sector of their attack close to Douaumont.

Next day, 26th Feb., brought the fateful hour of the struggle. Pétain's reinforcements were at hand. The Germans made their supreme effort on a 2-mile front at Douaumont, and the picked 24th Brandenburg Regiment was the spear-head of an assault which at one moment burst its way into the Fort Douaumont trenches between the village and redoubt—a fine feat of arms which evoked this telegram from the Crown Prince's head-quarters: "Douaumont, the eastern pillar of the Verdun defences, is solidly in German hands". The adverb alone was misplaced. The position was not held solidly, for Pétain's reserves, thrown in at the exact moment, flung back the Germans and prevented the leak in the defences from being widened by any further inrush.

This counter-attack, made by men of Balfourier's 20th Corps, marked, indeed, the turn

of the struggle, for though Douaumont, and Vaux after it, were subsequently to be lost, together with many other historic redoubts and shell-battered points of vantage on either side of the Meuse, and though many thousands of lives were to be swept away in attack and counter-attack on the barren hills about Verdun, yet henceforward the assaults were no different, except in weight, from others which in 1916 and 1917 were projected by the Germans or the Allies on the amplifying complexities of the armoured defence lines. Von Falkenhayn's subsequent comment on the operations, which marked the beginning of the creeping paralysis of his plan, was that violent French counter-attacks began, and the German forward movement on the heights was stayed.

Though the crisis was over there were many great moments of sleepless effort, of anxiety, and heroism in the months to come, for the last purposeful German assaults on the fortress were made on 15th June, and on 14th July the Germans were still occupying the French with assaults developing from the Thiaumont redoubts, which marked the farthest point southwards to which their long-sustained effort had taken them. Following on these attacks was a considerable pause, during which the Germans were fully occupied elsewhere in dealing with the British attacks on the Somme. The last phase at Verdun in 1916 was that in which the French, inspired by the methods of General Nivelle, thrust the Germans out of all the positions so painfully won, and re-occupied by mid-December very much the same lines as those from which the great push of the last week in February had rejected them. The story of Verdun cannot here be told in detail; its principal events are dated as follows:

27th Feb.—Germans take Tulou Ridge.

3rd March.—Germans enter Douaumont village.

7th March.—Germans, transferring their efforts to the west of the Meuse, capture Hills 300 and 205.

14th March.—Germans penetrate west of Verdun the line Béthincourt-Mort Homme.

20th March.—Germans enter Avocourt Wood.

20th March.—French recover Avocourt Redoubt.

1st April.—Germans, renewing their attacks east of Verdun, capture part of Vaux village.

10th April.—Germans make extended attack on both sides of the Meuse, failing at the Mort Homme, but gaining at Poivre Ridge.

5th May.—Germans, renewing westerly attacks, gain a footing on Hill 304.

20th May.—Germans in a great attack on

Mort Homme capture summit of Hill 295.

The attack next day enlarged the gains.

24th May.—Cumières and Fort Douaumont captured by Germans.

1st June.—Fresh German attack at Fort Vaux east of Verdun.

7th June.—Fort Vaux captured after six days' fighting.

17th June.—Attack renewed at Mort Homme.

The attacks on both sides of the Meuse were prosecuted with increasing vigour till 28th, during which period the Germans took Hills 321 and 320, as well as Thiaumont Fort (23rd June) and Fleury (24th June). Fleury marked the point of their farthest advance towards the inner line of defences east of the Meuse at Forts Souville and Tuvannes. The tide now paused, and on 30th June, a day before the British attack on the Somme, the French retook Thiaumont. The fighting went on in a restricted but incessant way through the rest of June and July, the French gradually improving their position. In August activity was renewed at Thiaumont and Fleury.

18th Aug.—French retake whole of Fleury.

9th Sept.—French retake trenches between Fleury and Douaumont.

24th Oct.—The French, after a long pause for readjustment, and now under the direction of General Nivelle, recapture village and fort of Douaumont, Haudremont quarries, and 4500 prisoners. They thus advanced to lines held in May.

3rd Nov.—Vaux recaptured. On 30th Nov. the German Crown Prince resigned the command of the Verdun front.

15th to 16th Dec.—General Nivelle (who succeeded General Joffre as French Commander-in-Chief on 12th Dec.) orders new attack at Verdun. Vacherauville, Poivre Ridge, Bezonvaux, Hardaumont recaptured with 11,000 prisoners.

In early 1916 the British army was still finding itself, and its new Commander-in-Chief, Sir Douglas Haig, regarded it as insufficiently trained and equipped for the great tasks which lay before it. As an instrument of war it was still not yet ready. It also remained, if not in a water-tight compartment in respect of the French armies at its side, yet with a separate command and in separate control. This may have been merely the necessary consequence of its state of training; but it is certain that in 1916 there was no one with authority to compel that unity of action and command which in 1918, but not till then, directed the Franco-British armies as one force. Fortunately, perhaps, the German High Com-

mand elected to attack the French at Verdun instead of throwing their whole weight on the British, though there were numerous smaller actions along the worn and dangerous Ypres front and elsewhere in the first half of the year.

On 14th Feb. the enemy captured some 600 yards of 'International Trench', south-east of Ypres, but they were regained on 17th March, when a bitter and protracted struggle also began for the mine craters at St. Eloi. These were lost and recovered more than once, with heavy casualties on both sides. The Canadians, who had their full share of these costly operations, were again sorely tried at the beginning of June, when the Germans penetrated their front trenches in a surprise attack on the 2nd of that month. Major-General Mercer was killed in this assault, and General Williams captured. Eleven days later the Canadians atoned for this set-back by completely re-establishing their broken line. Throughout the first half of 1916 the enemy, not only round Ypres, but also round Arras, at Ploegsteert, Givenchy, and elsewhere, persevered in similar local attempts to keep the British occupied and upset their plans, while he was concentrating his chief efforts towards beating down the French defences at Verdun. The attack on Verdun, as already related, ultimately broke down, and the period in which it was at its height was utilized by Sir Douglas Haig to bring his forces as near as possible to the point at which they could undertake with success an attack of the first magnitude against the entrenched German lines. The date of the attack was premature, and was hurried on in order to take some weight off the harassed French armies at Verdun. It began on 1st July; the chosen *terrain* was the River Somme, and the great offensive, in which the French joined, was over a 28-mile front from Gommecourt, north of the Somme, to Dompierre, south of that river.

#### *First Battle of the Somme*

The German position in the Somme area was situated on the high ground which is the watershed between the Scheldt and the Somme. The ground runs east-south-east, and its hills fall into long irregular spurs divided by wide valleys. On the forward slopes of the hills the German first-line defences ran from the Somme at Curlu to Fricourt; at Fricourt the defence line turned north, crossing the Ancre, thence passing over the summit of the watershed near Hébuterne and Gommecourt to Arras. Between the Somme and the Ancre a second line of defence had been constructed 2 miles behind the first, and on it had been lavished all the ingenuities of fortification which the German engineers afterwards developed in the so-called Hindenburg lines.

South of the Somme, where the French were to co-operate with Sir Douglas Haig, the defences were not so elaborate; it was not here that the Germans, who were fully aware of the impending British attack, expected the blow to fall. They expected the greatest weight to be felt towards the Ancre.

The British preparatory bombardment, delivered by a force of artillery far greater than any British army had heretofore possessed, began on 24th June, and deluged the German positions with shells for a week. It was aided by the efforts of the Royal Flying Corps, which, at this time, had a decided superiority over that of the Germans. The British attack on 1st July began in broad daylight, and was delivered principally by Rawlinson's Fourth Army of five corps, with a subsidiary attack by the Third Army (Allenby) opposite Gommecourt, where one corps only was sent forward. The sectors attacked, beside that at Gommecourt, may be designated: Beaumont-Hamel; River Ancre, including Thiepval, La Boissele and Contalmaison; Fricourt; River Somme at Montauban. The French attack, directed by Foch and delivered by the French Sixth Army (Fayolle), and Tenth Army (Micheler), was delivered along an 8-mile front, taking in a sector on either side of the Somme from Maricourt, through Frise and Dompierre, to Fay.

Severe as were the British preparatory and final bombardments, they did not succeed in demolishing the German systems of defences, and had left machine-gun nests intact. The efficacy of the machine-gun was one of the bitterest lessons to be learnt by the flower of the British armies of 1916, and the great losses of 1st July were largely due to the German handling of this weapon. Taking the British and French attack as a whole, it may be said to have failed towards the north and succeeded towards the south. The heaviest rebuff was inflicted on the corps of Allenby's Third Army which operated opposite Gommecourt. From Thiepval, across the Ancre, the Germans had massed their best fighting material and the greatest weight of their artillery. The 10th Corps (Morland), which included the famous 36th (Ulster) Division, Highlanders, and North Countrymen, did wonders, and actually penetrated the Thiepval Redoubt but could not hold on to its gains. Hunter-Weston's 8th Corps of picked troops, including the 29th Division from Gallipoli, found the task of assaulting Beaumont-Hamel too strong for them. Farther south there were successes which increased in value towards the Somme. The 13th Corps (Congreve) carried Montauban and Mametz; the 15th Corps (Horne) surrounded Fricourt; the 3rd Corps (Pulteney) forced its way at great cost into La Boisselle.



The French armies, well handled, and aided by the advantage of finding the Germans less on their guard, made ground on either side of the Somme. Three corps participated in the assault—the 20th (Balfourier) from Maricourt to the Somme, where the hardest fighting was at Curlu and Harllecourt; the 1st Corps (Brandelat); and the 34th Corp (Allouier). The last two walked through the Germans, and the French losses were light. As a result of the day's fighting along the whole front, the British captured 3500, and the French 6000 prisoners; but the casualties of the assailants were close on 50,000. The second day's fighting, though it emphasized the certainty that no great German defeat had been effected, enabled both the French

British commanders to enlarge the ground they had won, and their advantage was further exploited for the two days that followed. By the 5th of July over a front of 6 miles the Germans had been pushed back a mile; the British had captured 6000, the French 8000 prisoners.

This was the first blow in the Somme battle. Its results compared with those of the German attack on Verdun, do not afford warrant for saying it is a great victory. It became clear that there was no precedent to follow other than that of the Germans at Verdun, namely, a systematic reducing of the enemy's power. The heavy task was entered on by the British forces with unbroken determination; and the effort relaxed scarcely any of its vigour.

18th Sept., while the last big British attack on the Ancre began; 18th Nov. The principal events in this protracted struggle for positions and fortified strongholds after the opening phase already described were.

14th to 15th July.—British attack German second line, capturing Longueval, Trônes Wood, Delville Wood, and 2000 prisoners.

23rd July.—Second phase of Somme battle begun. Pozzères captured 26th July.

6th Aug.—French take Belloy near the Somme, 1300 prisoners.

25th Aug.—Total British captures on Somme to date: 260 officers, 15,203 men, 80 guns.

14th Sept.—British advance (third phase of Somme battle) using tanks for the first time; Martinpuich and High Wood taken. Lesbarns and Morval captured 25th Sept. Combles and Thiepval captured 26th Sept.

30th Sept.—Thiepval Ridge captured.

10th Oct.—French take Ablaincourt, south of Somme, and 1300 prisoners.

21st to 23rd Oct.—British take 1018 prisoners.

12th Nov.—French take Saillisel.

18th Nov.—Battle of the Ancre (fourth phase of Somme battle). British take 4000 prisoners.

20th Dec.—Sir D. Haig's dispatches relating to Somme battle. During the period 1st July to 18th Nov. were captured 38,000 prisoners, 125 guns, 514 machine-guns. The number of casualties inflicted on the Germans has not been made known. Those of the British amounted to 22,928 officers and 476,558 men. A number of these were, of course, not permanent casualties.

#### *Russian Campaign, 1916*

During the winter of 1915-6 the Russian armies were reorganized by General Alexieff under the nominal command of the Tsar. The Grand Duke Nicholas, as already stated, went to the Caucasus in 1915, and while Viceroy there the successful advance of General Yudenitch to Erzerum (captured 16th Feb.) was made. The Russian armies of the north were placed under General Kuropatkin (Riga to Dvinsk) and General Kverts (Vilna to the Pripet), and the commands embraced respectively the Twelfth, Fifth, and First; and the Second, Tenth, Fourth, and Third Armies. In the southern group of armies, commanded by General Ivanoff till April, and by General Brussiloff afterwards, were included the Eighth Army (Kalelin) in the Rovno sector, Eleventh Army of Volhynia (Sakharoff), Seventh Army of Eastern Galicia (Scherbacheff), and Ninth Army of the Dniester (Lechitsky). Facing the northern group of armies were German forces directed nominally by General Hindenburg, actually by General Ludendorff. The local commanders were von Below and von Scholtz (Riga to Dvinsk), von Eichhorn (Lake Narotch), von Fabeck and von Woyrsell with an Austrian army corps. A force under the nominal command of Prince Leopold of Bavaria connected these German armies with those which faced General Brussiloff (successor to Ivanoff). The Volhynian sector (Third Austro-Hungarian Army) was under von Brlog; Rovno sector (Fourth Army) under the Archduke Joseph Ferdinand, stiffened by a reserve under von Linsingen. Farther south were General Boehm-Ermolli's army (Second), and the two armies of Bothmer and Pflanzer-Baltin. The Russians, who had been recruiting far larger numbers than they could feed or employ, were much more numerous. The Germans were well entrenched and superior in artillery.

The German effort in 1916 was diverted to the West. The Russians, who were now better supplied in guns and ammunition than heretofore, seized the opportunity to take and keep the initiative in the East. They began before the end of 1915 with an offensive in Galicia on the Stry and Strypa, and continued their attacks

through January; while in February there was severe fighting on the Dniester, in the Bukovina, and in Volhynia. The first full-dress attack was made, however, in the northern sector, where General Rverts began the battle of Lake Narotch on 18th March. Fighting here was renewed eight times before 14th April, and the Russian gain on the Vilna road did not warrant the heavy losses (12,000), which were increased by a German counter-attack on 28th April.

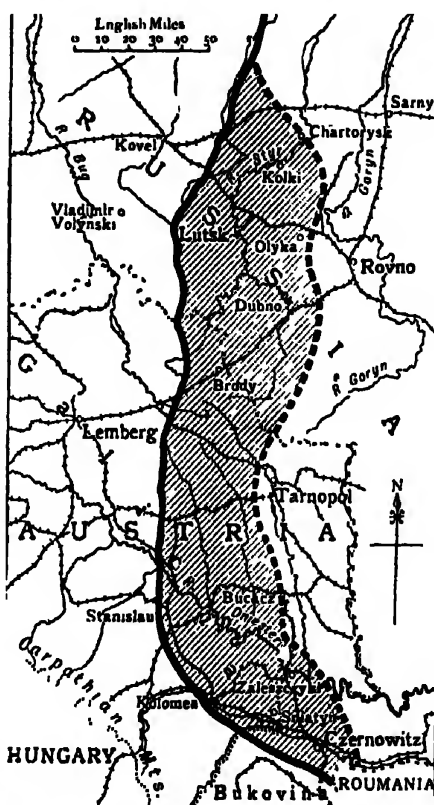
The important part of the Russian campaign took place in the southern group of armies commanded by Brussiloff, who used his superiority of numbers against the Austrian generals and their very mixed troops with brilliant effect. On 4th June the Russian armies from the Pripet to the Bukovina were set in motion simultaneously against the long unequally guarded Austrian front, seeking the weak places. Generals Kaledin and Sakharoff, in the sectors nearest the Pripet, engaged the armies of von Brlog and the Archduke Joseph Ferdinand; and the Russian columns, though held up in the marshes supporting von Brlog near Kolki, swept through the archduke's defences like paper. They marched swiftly forward over rolling country to the Stry, driving the Austro-Hungarian levies before them. By 16th June the leading Russian columns were 12 miles from Vladimir Volhynok. North of this apex Kolki and Svidniki, on the Stokhod, were captured; south of the so-called Lutsk salient thus created Sakharoff captured Dubno, and was outside Brody on the 10th. In twelve days this most damaging attack captured 70,000 men, 83 guns, and created a salient which, at its greatest depth, was 50 miles from the 80-foot base from which it had been started. Von Linsingen's reserves were sent in, and Ludendorff took matters in hand.

General Scherbacheff had simultaneously attacked von Bothmer from Kozlov to the Dniester. The Russian general reached Bucacz (8th June) and crossed the Strypa. He also captured 17,000 prisoners and 30 guns, but von Bothmer, athwart a good line of railway, could not be enveloped, and fell back sullenly and without disaster.

General Lechitsky, in the most southerly sector, struck with fury at Pflanz-Baltin, and cut through his centre on the hills between the Dniester and the Pruth while turning his flank at the Dniester bridge-heads at Zaleszczyki and Biakupie. The net result was the wreck of Pflanz-Baltin's army, which was forced to retreat across the Pruth to the Carpathians. Lechitsky captured 39,000 men; and Brussiloff's great attack had succeeded triumphantly on both wings. It had made less headway in the centre. There were two lines of subsequent

pressure or advance open to him, one, the more northerly, towards Kovel; the other, with, as object, the further destruction of the southern Austro-Hungarian armies, towards Halicz.

Ludendorff, however, had by this time formed his plans for the restoration of equilibrium; and Linsingen, with his reserves, was employed to



Map illustrating the extent of Russian Recovery in the Summer Campaign of 1916

make amplification of the Russian success at the most northerly portion of the salient impracticable. Linsingen struck at the Stokhod River crossings. Brussiloff countered by bringing up a fresh army under General Lesch with the object of outflanking Linsingen in his turn; and another army, under General Rogoz, was ordered to occupy General Woyrsch's attention farther north. These manoeuvres had considerable success, Lesch and Rogoz capturing 17,000 men. But though in these and subsequent engagements the largest numbers of captures fell to the Russians, and though in the extreme south they



were again able to advance to the Carpathian passes, no disaster on the largest scale was inflicted. The Germans were able to withdraw their allies and to allow the Russian attack to wear itself out.

Nevertheless, the Russian victories were of immense service to the Allies, and by the autumn of 1916 it seemed that the prospects of the Central Empires were darker than at any period of the war. The Russian advance, in its resolution and generalship, need not shrink from a comparison with that with which Foch ended the war two years later. By the middle of September, Generals Kaledin, Lesch, Sukharoff, Scherbatscheff, with Bezobrazoff and Lechitsky in the south, had captured 370,000 prisoners, 450 guns, and an amount of supplies as great as that which fell into Ludendorff's hands at St. Quentin in 1918.

#### *Balkan Campaign, 1916*

After the conclusion of Brussiloff's triumphant dissipation of the Austro-Hungarian armies in the early autumn of 1916, the way was open for Roumanian co-operation with the Allies, and Roumania, though neither united nor completely ready, was urged to enter the war. This she did on 28th Aug., when Germany declared war on her, and Italy made a belated declaration of war on Germany. On 29th Aug. von Hindenburg was appointed Chief of the German General Staff in succession to von Falkenhayn, to whom was relegated the task of dealing with Roumania. The Russians during the rest of the year advanced towards the foot of the Carpathian passes and to the junctions of the knot of railways in South-Eastern Galicia, in order to gain complete contact with the Roumanians through the Bukovina. Meanwhile the Roumanians, instead of concentrating on their southern front, where a mixed force of Bulgarians, Turks, and Germans under the command of von Mackensen was preparing to take them in the flank, pressed forward through the easterly passes of the Carpathians into Transylvania. They advanced here some distance, practically striking a blow in the air, but neither raising the Transylvanian population nor capturing any strategic points. On 2nd Sept. Russian forces in aid of Roumania crossed the Danube into the Dobrudja, while on 3rd Sept. Brussiloff's troops won a considerable victory in South-East Galicia, and on 7th Sept. took Halicz. But this success was more than offset by the loss to the Roumanians on their southern front of Tulnakan, on the Danube, with 20,000 prisoners. Occurrences were symptomatic of what was to come; and again, on the Eastern, as on the Western front, the Allies suffered from the lack of unity of command.

The Russians and Roumanians joined hands on 10th Sept., but never concerted their strategy. Mackensen continued to advance along the Danube towards the vital Cernavoda Bridge, and so to threaten the whole of Southern Roumania, while the Russian forces which, on the east, had ventured into Roumania, found themselves by 18th and 19th Sept. faced with the new forces concentrated by the Germans against their eastern Transylvanian front. The rest of the Roumanian campaign is the history of the stages by which the two arms of these German-made 'nut-crackers' closed on the Roumanian armies, which had been placed in a false strategic position and were badly led. On neither front did the Roumanian soldiery, who fought well under very trying conditions, with inferior artillery and a poor medical service, give way without a struggle. Mackensen was stoutly held up on 20th Sept. in the Dobrudja, and on the Transylvanian side the Roumanians had a success on 27th Sept. But on 30th Sept. Falkenhayn developed his eastern attack near the Roter Turn Pass, and by 7th Oct. the whole Roumanian front in Transylvania was retiring by the way it had come. A week later it was out of Transylvania and defending the not very defensible passes.

On 20th Oct. Mackensen attacked on the whole line in the Dobrudja, and five days later he was on the vital Cernavoda Bridge. Constanza, the Roumanian Black Sea port, had fallen, and so far from ever being in a position to take Turkey or Bulgaria in the flank, the Roumanians were now themselves on the verge of being outflanked on the Danube. Meanwhile, on the other arm of the nut-crackers, von Falkenhayn, despite trifling set-backs, was pressing on. The Törzburg Pass (21st Oct.), Predcal Pass (23rd Oct.), Vulkan Pass (25th Oct.), Roter Turn Pass (31st Oct.) were all scenes of Roumanian reverses, and by 15th Nov. the bulletins were bringing the daily news that the Roumanian retreat continued. On 23rd Nov. Falkenhayn was advancing on Bucharest; Mackensen had crossed the Danube at Islatz and Simniz; and farther west Orsova and Turnu-Severin had fallen. All the German composite forces could now be deployed in Roumania, and the end followed swiftly. Mackensen and Falkenhayn were in touch on 26th Nov.; Campolung was captured 29th Nov.; Bucharest, Ploesti, and Sinuin fell on 6th Dec.; and with them went the Roumanian oil-fields, the wells of which had, however, been very thoroughly damaged by Captain Norton Griffiths and a small British party in order to prevent their use by the Germans. (They were restored in some eight months.)

On 8th Dec. the Germans estimated their Roumanian captures as 70,000 men and 184

guns; and it is true that only a portion, though a considerable one, of the Roumanian armies was able to effect a retreat with the Russians to the line of the Sereth defences. Fighting went on till the end of the year, and was continued into 1917 until the Roumanians were forced to sign the Treaty of Bucharest—revoked by the Allies at the end of the war.

Roumania's fate, following the tragedy of Serbia and the Allies' withdrawal from Gallipoli, strengthened the Greek military party round King Constantine, which was now openly pro-German. Against these influences M. Venizelos proved powerless, though Greek volunteers were at the same time joining the Venizelos party, and ready to fight with the Allies. This division of opinion in Greece was illustrated in the middle of August (1916), when two divisions of the 4th Greek Army Corps surrendered to the Bulgarians, who had advanced to the Greek port of Kavalla, while the 3rd Division of the same corps joined the Allies at Salonika. The pro-Germans had carried all before them at the last Greek elections (Dec., 1915), when the Venizelists declined to poll; and the danger of finding themselves suddenly attacked in the rear discouraged an Allied offensive against the Bulgarians until the autumn of 1916, when the newly equipped Serbian army arrived from Corfu, ready and eager to fight its way home, joining the force under General Sarrail, which already included Russian, Italian, and Portuguese contingents, besides French and British. Following pro-German riots against the Allied embassies in Athens, too, a 'pacific blockade' of the Greek coast had been enforced, and a firm Note presented to the Greek Government demanding the demobilization of the Greek army and a new general election, to be freely conducted. When these demands had been accepted and a new Government formed—though the king's pro-German sympathies remained as marked as ever—General Sarrail resumed, in September, the offensive against the Bulgarians. The main advance was undertaken by the French and Serbian divisions, with a Russian contingent, in the direction of Monastir, General Milne's British column meantime pushing the Bulgarians back from the Struma line. Two months' fighting saw the Serbians, who had borne the brunt of the attack at this point, marching back into Monastir in triumph, having turned the Bulgar-German forces out of it on 18th–19th Nov. The British, at the same time, kept the enemy busy at the other end of the line, occupying a number of villages, and pushing the Bulgarians back beyond the railway between Seres and Demir-Hissar. With their heavy commitments elsewhere the Allies were for the time being unwilling to extend their military operations beyond Monastir.

### *Italian Campaign, 1916*

Italy, who for political as well as military reasons had declined further assistance in the Balkans, had her share of hard fighting within her own frontiers in 1916. Before she could resume her advance on Gorizia and Trieste (held up in the early winter of 1915) the Austrians attacked in turn from the Trentino under General Conrad von Hoetzendorf, who, planning a drive on the Mackensen scale, aimed a blow at the tempting Venetian plains. The grand attack, supported by upwards of 2000 heavy guns on a 30-mile front between Val Sugana and Val Lagarina, and delivered on 14th May by some 350,000 first-class troops, smashed a way through in the centre. Though the flanks held firmly, and the Italians, roused to fury by the invasion, fought magnificently among the mountain heights, General Cadorna ordered the line to be withdrawn from its untenable positions until it was south of Asiago. Pressing their advantage with every means at their disposal, the Austrians announced in an Army Order on 1st June that only one mountain intervened between their troops and the Venetian plains. Cadorna, however, had now been reinforced, and two days later was able to reply that the Austrian offensive had been checked. For the rest of the month he was content, in this sector, to sustain the continued but unavailing assaults of the enemy, while he prepared his own great counter-attack on the Isonzo front, with Gorizia, the gateway to the plateau of the Carso which led to Trieste, as his immediate objective. This dramatic move, heralded by an intense bombardment on 6th Aug., was entrusted to the Duke of Aosta, whose Third Army, after three days' fighting of the fiercest description, carried the last heights defending the town and entered Gorizia in triumph. Following the retreating enemy across the Carso, the Italians, whose enthusiasm for the war had been greatly stimulated by 'his fine feat of arms—Italy's belated declaration of war on Germany followed upon the Gorizia victory—continued their advance across the northern end of that formidable plateau, winning a number of considerable battles, and capturing before the end of the year between 30,000 and 40,000 prisoners, but never succeeding in mastering the Carso as a whole.

### *Naval War in 1916—Battle of Jutland*

The battle of Jutland, which took place on 31st May, 1916, overshadows all other naval operations in that year; nevertheless, there were several other events of importance which preceded it, or were in some way related to its occurrence afterwards. For example, in the

earlier months of the year the German raider *Moewe* was at large, and inflicted considerable damage on British shipping before returning safely to a German port; the mercantile submarine *Deutschland* left Germany for the United States and returned in safety; and another German submarine, U 53, also crossed the Atlantic with more belligerent intent, and sank several merchant vessels off Rhode Island on 8th Oct. The new development of the submarine war, in which Germany declared her intention of sinking merchant ships at sight, begun on 1st March, and one of its most important consequences was the dispatch of a United States Note by President Wilson to Germany (18th April) in respect of the sinking without warning of the *Sussex* and other unarmed vessels. Another outcome of the German submarine warfare was the sinking of British hospital ships in the Mediterranean. Furthermore, following the battle of Jutland, and related in some respects to its only partially decisive character, the *Hampshire*, with Lord Kitchener and his Staff on board, was sunk off the north of Scotland (5th June) by striking a mine that is said by the Germans to have been laid by one of their submarines; and on 10th Aug. the German High Seas Fleet was able to come out again, though it sought no action, but avoided one. Two British light cruisers, the *Nottingham* and *Falmouth*, were sunk in the search for its whereabouts.

The 'partially decisive', or 'indecisive', character of the battle of Jutland are relative terms, and their exact implication has been, and must continue to be for a long time, a matter of controversy. On the one hand, the aim of Admiral von Scheer, the Commander-in-Chief of the German High Seas Fleet—to catch a portion of the British Grand Fleet and attack it while isolated and unsupported—was frustrated, and in that respect the German admiral failed. On the other hand, Admiral Sir John Jellicoe's purpose of destroying the German Fleet, if and when he succeeded in engaging it, also failed, as may be understood from its subsequent emergence from its harbour in August, and the later development of the German submarine campaign, which could not have taken place had not the Germans possessed the framework of a fleet to support the under-water vessels. Sir John Jellicoe justifiably claimed that his action preserved intact the main forces of the British Grand Fleet, and left them as before in command of the outer seas, while demonstrating to the Germans that they could not again engage in a naval battle on a large scale with any hope of success. Admiral von Scheer was entitled to claim that he had engaged a superior British force, had inflicted on it more material damage than he had sustained, and had withdrawn the

bulk of his forces to remain, as before, a menace, not to British safety, but to British unfettered control of the seas. The details, in outline, of the battle of Jutland are as follows.

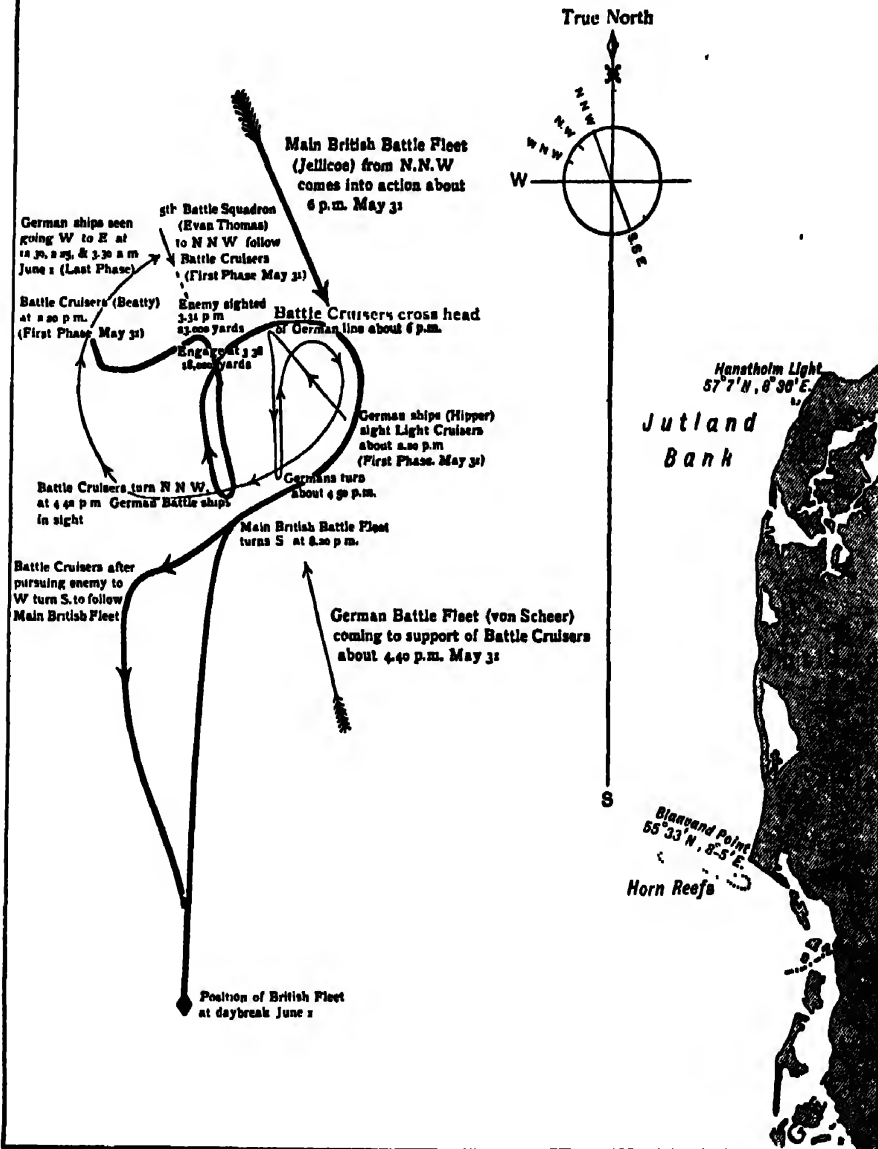
On 30th May the Grand Fleet under Sir John Jellicoe left its three Scottish bases for a sweep of the North Sea, Sir David Beatty, with the battle-cruiser squadron, *Lion*, *Queen Mary*, *Princess Royal*, *Tiger*, *Indefatigable*, and *New Zealand*, and Sir Evan Thomas, with the four battleships of the *Queen Elizabeth* class, *Barham*, *Malaya*, *Warspite*, and *Valkent*, setting out from the most southerly of these bases, Rosyth. At 2 p.m. on 31st May Sir John Jellicoe, with the Battle Fleet in 6 divisions, was steaming line-ahead between Aberdeen and the north end of Jutland, in order to meet Sir David Beatty at an appointed rendezvous in the North Sea. Sir John Jellicoe's 6 divisions were, lined east to west, 1st Division (Jerrani), *King George V*, *Ajax*, *Centurion*, *Erin*; 2nd Division (Leveson), *Orion*, *Monarch*, *Conqueror*, *Thunderer*; 3rd Division (Jellicoe), *Iron Duke*, *Royal Oak*, *Superb*, *Canada*; 4th Division (Sturdee), *Benbow*, *Belshazzar*, *Temeraire*, *Vanguard*; 5th Division (Gaunt) *Colossus*, *Collingwood*, *Neptune*, *St. Vincent*; 6th Division (Burney), *Marlborough*, *Revenge*, *Hercules*, *Agincourt*.

Both Jellicoe's and Beatty's forces had their attendant suites of destroyers, light cruisers, and other cruisers. The British Grand Fleet in all was constituted of 41 'capital ships', made up of 28 battleships, 9 battle-cruisers, and 4 armoured cruisers. It had also 103 'ancillary craft', made up of 25 light cruisers and 78 destroyers. The German fleet consisted of 20 battleships and 5 battle-cruisers, or 25 'capital ships'; there were also 11 light cruisers and 88 destroyers. In gun power and weight of projectile the Grand Fleet had a striking superiority over the German fleet, and Admiral Jellicoe had apparently a valuable superiority in speed. In his own account of the battle he observes that the speed of some of the German ships had been underestimated.

There was no clear expectation on the British side of meeting the Germans when the Grand Fleet set out for its sweep on a line drawn from Wick to the opposite coast of Norway, with Beatty's 6 battle-cruisers and Evan Thomas's 4 battleships as advance-guard; and when von Scheer set out for the north from Helgoland Bight at daybreak, with an advance-guard of 5 cruisers, supported, 50 miles behind, by 16 Dreadnoughts and 6 slow pre-Dreadnoughts, he had no intention of seeking a general action.

The meeting of the advance squadrons began when both were on a level with the northern end of Jutland. Admiral Hipper, who commanded the German cruisers, turned round from north

# The Battle of JUTLAND BANK May 31-June 1, 1916



Map showing the approximate positions of the British and German Fleets at various stages of the battle

to south to rejoin his main fleet; he was then east of Admiral Beatty. Beatty followed him, at some disadvantage from smoke and haze. Evan Thomas's battleships were too far behind at this stage to join in the engagement. Hipper fended off Beatty with destroyers as best he could in the hour before the German main fleet could come up, and in that hour *Queen Mary* and *Indefatigable* blew up, shells from the German ships, on which the system of fire control appeared to be more accurate than the British, reaching their magazines.

When the German main fleet was seen to be approaching in support, Beatty turned with his 4 remaining cruisers, and Evan Thomas's 4 battleships fell in behind. These 8 were stronger than the German advance 5, and swifter, so that Beatty did not execute a mere retreat but pressed on Hipper, making him turn east, and thereafter placing the British ships on the German line of retreat to Heligoland—'crossing the T', as the manœuvre is called.

Meanwhile Jellicoe's 6 battle divisions were coming on in an oblong of 6 lines of 4 ships each—the long sides of the oblong north and south, the short, east and west. Thus steaming, Jellicoe came into contact with Beatty and Evan Thomas engaged on the east side of the German line, whose head they had fixed round and were themselves going south. Beatty and Thomas were thus between Jellicoe and the Germans, and it behoved the British Commander-in-Chief to see that his ships did not hurt one another with their fire. Jellicoe effected the necessary deployment, not in the manner that he had premeditated, but in that which circumstances forced him to employ. It was the less simple way, and the Grand Fleet was not in line till half-past six.

The Germans had no prudent course but to retreat, which they did in the haze and chemically-created smoke—both fleets going to the south-west, curving to west. The fleets were hammering each other as hard as they could; but when darkness came down the German fleet, badly damaged but not seriously diminished in numbers, was still fighting in retreat. Admiral Jellicoe, in his own account of the battle, remarks: "At 9 p.m. the enemy was entirely out of sight, and the threat of torpedo-boat destroyer attacks during the rapidly approaching darkness made it necessary for me to dispose the fleet for the night with a view to its safety from such attacks, whilst providing for a renewal of action at daylight".

The opportunity for renewal at daybreak did not come; nor was it likely to have come, since von Scheer's first preoccupation was naturally not to fight a superior force under conditions least favourable to himself. It is therefore

proper to state that the British Commander-in-Chief thought it wiser to break off action with his main fleet lest it should suffer too greatly in the turmoil and confusion of a night attack. The arguments in favour of this decision are several; the chief of them being that Admiral Jellicoe kept the British fleet and naval power intact, and another being those which the British admiral himself advanced, namely that he was not completely aware of how his own fleet and that of the enemy lay to one another, and that "the result of night actions between heavy ships must always be a matter of chance". Admiral Jellicoe did not feel justified in gambling on such a chance. He did what he told the Admiralty he should do in such circumstances, as recorded in a dispatch written on 30th Oct., 1914, and published at the end of the official *Battle of Julland* in justification of his action: "If the enemy battle fleet were to turn away from an advancing fleet", he wrote on that occasion "I should assume that the intention was to lead us over mines and submarines, and should decline to be so drawn". The italics are Lord Jellicoe's own.

#### 1917 on the European Fronts

*The Russian Campaign.*—On the Eastern front fighting on the grand scale had died down by the beginning of 1917, the Germans having exhausted the momentum of their advance under Mackensen, and accomplished their main purpose of putting Roumania out of account as a serious adversary. Along the line of the Sereth, and in the Bukovina, deadlock was reached in the spring of 1917. By that time the creeping paralysis which was seizing the Russian armies was making itself felt in this, their most distant tendon. Throughout April, May, and June the daily record of occurrences on the Eastern front is blank except for one attack by the Germans on the Stokhod (3rd April).

For the explanation of their quiescence the record of political events has to be scanned. It was well known on the Continent, though it was kept hidden from the British public during the winter of 1916-7, that the integrity of the Russian armies was crumbling, that soldiers were fraternizing with the enemy, and that a general revolution was being prepared by those forces of socialism and anarchy which had been thrust under, but had never lacked exponents, since the abortive revolution of 1905. The mismanagement, the corruption, and the bitter hardships of the war had given them their opportunity, and these were the 'Dark Forces', more than the rogue Rasputin, the parasite of the Russian Court, which undermined the influence of the monarchy, and extinguished Tsar

and Court, bureaucracy, aristocracy, and army in a common ruin. It was said in Europe during the winter of 1916-7 that the Allies would have to choose between the Russian monarchy and the Russian people; but neither the inertia of the Russian army nor the postponement of the re-opening of the Russian Duma acquainted the British public with the depth of the mischief that was working. The first inkling came on 12th March, 1917, when, following food riots in Petrograd, the Tsar ordered the suspension of the Duma. The Russian Revolution was the reply. Three Guard Regiments joined the people—the army had failed the monarchy. A Provisional Government was formed. Petrograd, Moscow, Kharkov, and Odessa joined it; and on 15th March the Tsar abdicated under compulsion. Several figures emerged from the crisis. M. Miliukoff, of the Constitutional Party, and Kerensky, a link with the Socialists, but the real forces at work did not at first show themselves.

On 24th March the army declared its loyalty to the Provisional Government, which two days before had been recognized by the Allies. For a time hopes were entertained that under this Provisional Government Russia would carry out her obligations to the Allies, and that her armies would fight; and every sort of device, including interchange of visits with representatives of British Labour and French Socialism, was employed to foster cordiality. The first sign of the essential futility of such hopes appeared on 4th May, when it was evident that the Russian Provisional Government was failing. A new coalition was formed, with Kerensky at its head, and loyalty to the Allies was urged and asserted. French and American missions visited Petrograd and Moscow, but no real consolidation was effected, though in the latter end of May and the beginning of June there was a remarkably deceptive appearance of it.

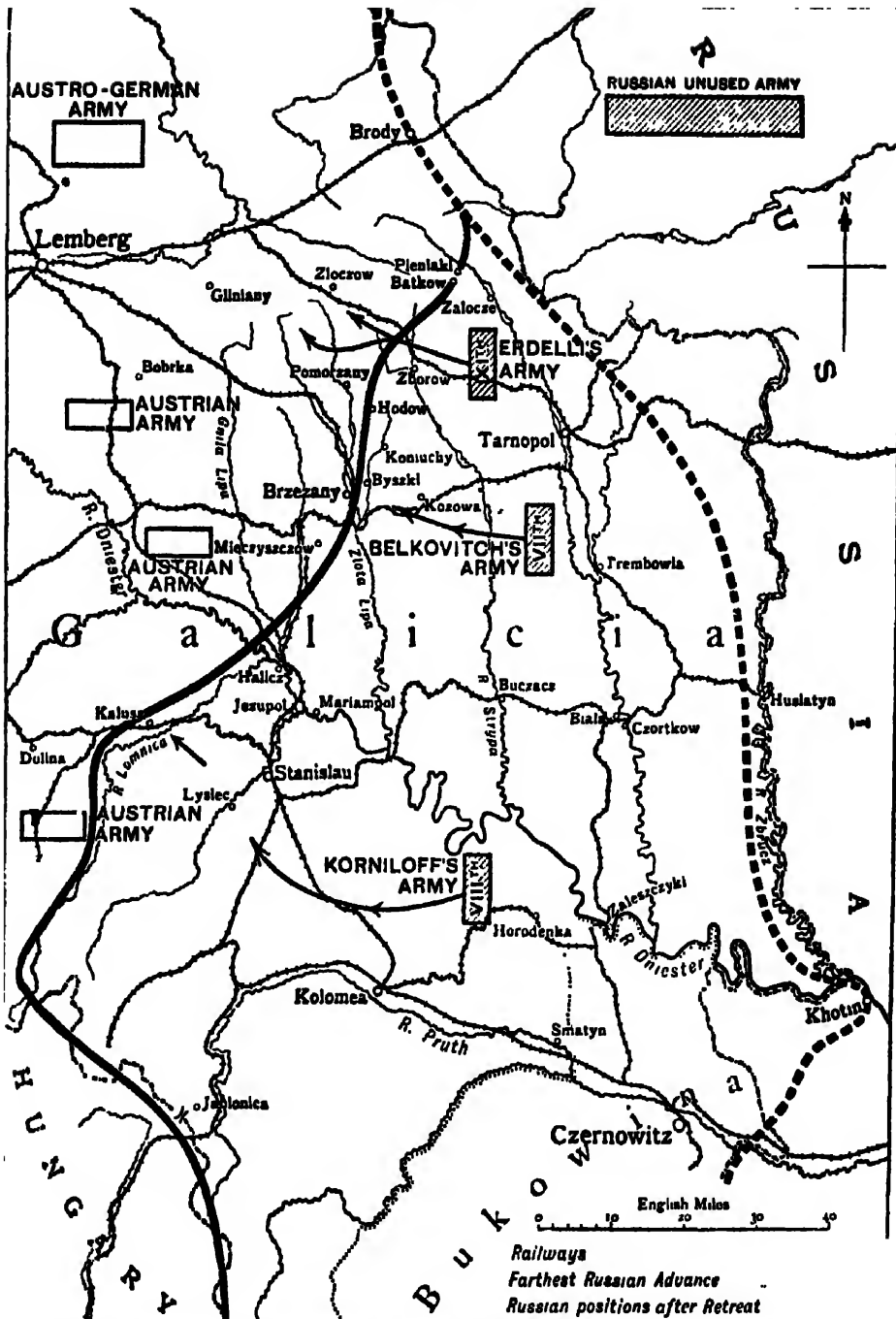
Under the spur of great efforts by M. Kerensky the army was stimulated into action once more, and a new offensive prepared. On such an offensive the Allies had placed high hopes, for the Russian armies in the spring of 1917 were better equipped and better provided with guns and ammunition than ever before. At first some of these hopes seemed destined to be realized. General Brusiloff, who had succeeded General Alexieff as Commander-in-Chief of the Russian armies, consented rather reluctantly, under the insistence of Kerensky—at that time engaged in a life-and-death struggle with the forces of the Bolshevik party led by Lenin and Trotsky—to organize an attack on the Austro-Hungarian front south of the Pripiet. It was believed that the soldiers of these southern armies were less tainted by Bolshevism than those in the northern

armies, and that a success here might rally the country to its older standards of patriotism. Brusiloff entrusted the offensive to General Gutor, who had in his favour the facts that the Austro-Hungarian armies were as war-weary as the Russian, and that the German Headquarters Staff, who were well acquainted with the extent of Russian disaffection, and had indeed been instrumental in inspiring and organizing it, were sceptical about the possibility of such an attack. Furthermore, in the sectors from Brody to the Dniester and beyond, where Lechitsky had halted in 1916, the Russians had a considerable numerical superiority—54 divisions to 30 composite Austro-Hungarian, Turkish, and German divisions, and were well equipped, well posted, and well supplied.

General Gutor directed three armies. The Eleventh, under General Erdelli, was to act along an 11-mile front from a point north-west of Tarnopol, and to get astride the railway which leads from Tarnopol through Zloczow to Lemberg. The Seventh Army, under General Belkovitch, facing Brzezany, was to cross the Zlota Lipa River, where von Bothmer had made his stand, and was then to wheel north-eastward in the same direction as Erdelli's army, with which it was to get in touch. If this movement succeeded, the combined armies were to advance towards Bobrka and the railway from Halicz to Lemberg. The whole of this task was through difficult country. Far to the south General Korniloff, with the Eighth Army, was entrusted with the turning movement. He was to overrun the Illicz region and to obtain control of the railway thence to Lemberg. If this wide turning movement succeeded, and if Belkovitch also did well, the Austro-Hungarian armies would be out-flanked and in danger of being rolled up, while pinned down in the north by Erdelli.

The venture was audacious, and the Russian commanders scarce dare trust their men. The Seventh Army's task in assaulting the Zlota Lipa line was such as would have tried the bravest and most loyal troops. The attack began on 1st July, and Belkovitch's men advanced bravely enough, protected by good artillery. In the first assault they took the river line and 2000 prisoners. But between the Zlota Lipa and its tributary Tsenlow was a death-trap, and the Russians were caught in a murderous cross-fire. The day was not lost; but at this critical moment occurred an incident which was symptomatic of Russia's disorders, and was the death sentence of Russia's continuance as a combatant. A division which might have turned the scale refused to advance.

The ground won was with difficulty held, and in the days that followed, the Germans, awakened to an unexpected danger, steadily reinforced the



Russia's Last Effort in 1917: map showing approximately the farthest line reached by the attacking armies, and the Russian positions after the retreat



weak point, while Russian battalions were refusing to stay in the front line. The situation reacted on Erdelli's troops farther north, where the Eleventh Army had done well at very little cost, and had captured 6000 prisoners by 3rd July. It became less difficult each day for the German directing staff to hold this attack in check, and it was stopped by 6th July. On the Dniester, Korniloff's army began to advance on this day—on which, according to plan, the enemy should have had all their attention concentrated on Erdelli and Belkovitch. Korniloff did very well. On 6th to 7th July he felt his way forward from Stanislaw to Dolina, and on 8th July, joining battle with von Bothmer, broke down resistance at Jezupol with ease, and sent forward his best arm, his cavalry, to the River Lukwa, 8 miles behind von Bothmer's first-line defences. Realizing his danger, von Bothmer counter-attacked, but was again borne down, and Korniloff's van reached the Lukwa. In two days' fighting Korniloff had broken through on a 30-mile front, and his main body, in the wake of General Chernioff's fighting division, poured into the plains of the Dniester. Theoretically a decisive victory had been won. It was in fact indecisive, because the leader's shock troops had been used up, and the situation was crumbling from within. His troops got intoxicated, mutinied, and he could use them no further.

But the rot now became dangerous to the point of mortality in the Eleventh Army of Erdelli. On 20th July, following a strong German counter-attack between Pienaki and Batkow, which was nearly the most northerly point of the advance, the 607th Mlynoff Regiment left the trenches voluntarily. They ran away, leaving the other regiments to bear the brunt of the attack. The breach widened as the Russians opened the gate. The German-Austrian attack, spreading to Zborow, found a Russian division ready to throw down its arms, and in a day the German-Austrian wedge was thrust in between the Eleventh and Seventh Russian Armies. The disaster was complete and irreparable. The command of the army group was hastily transferred from Gutor to Korniloff, but neither Korniloff's ruthless discipline nor Brusiloff's genius could alter the essentials of the situation, which were that the Russian armies would not fight, and were fleeing in panic.

All attempts to stop the flight were useless. On the night of 20th July the breach was 20 miles wide; on 21st July German guns were shelling Brusiloff's head-quarters at Tarnopol; on 23rd July the remnants of the Russian armies were retreating to the Sereth amid scenes of drunken brutality as disgraceful as any that the war has recorded, and only to be compared with those

that were to become common in Russia and Siberia in the struggle to establish Bolshevism. Farther north the Russian front imitated the cowardice and treachery at Tarnopol. On 25th July whole Russian army corps deserted the Dvinsk front, on which depended the safety of Riga. On the same day Korniloff was compelled to begin the relinquishment of the ground he had won with the Eighth Army. Stanislaw was abandoned; Kolomea followed on 27th July; Czernowitz went on 31st July; and the loss of the Bukovina followed that of Galicia.

For a time Korniloff seemed to have a chance of restoring coherence to some part of the Russian armies. He succeeded in wringing permission from Kerensky to enforce discipline. But the military-political understanding between these two, though it appeared to fail because of Kerensky's suspicions of Korniloff, whose arrest he ordered (on the 11th Sept.), was never a possibility. Russia was sick unto death. Her soldiers demanded peace; her peasants and townspeople asked for bread, and turned to Lenin and Trotsky, who promised both. During the summer there were many attacks by the Germans on the Riga front, which they used as a training-ground for their troops; and fighting of a similar character took place on the Russo-Romanian front. But on 16th Oct. the Germans, capturing Orsel Island in the Dvina, took the first step to the subjugation of the northern armies, and continued to take numbers of willing prisoners on the Riga front during the rest of that month. The bulletins of the fighting are contradictory and obscure, but by 3rd Nov. Russians and Germans were fraternizing on the Riga front, and on 20th Nov. hostilities ceased. Lenin demanded (1st Dec.) the surrender of General Dukhonnin, the then Commander-in-Chief, who was murdered two days later—the day after the negotiations between the Bolsheviks and the German peace delegation began at Brest-Litovsk.

#### *British Front in the West, 1917*

On the Western front it had been expected that the heavy hammering to which the Germans had been subjected during the battle of the Somme would be carried on in concert under the direction of Sir Douglas Haig and General Foch. But a change was made in the French High Command, General Joffre retiring, and his place being taken by General Nivelle, who had done so well at Verdun, while Foch was relegated to the task of preparing against a possible thrust of the Germans through Switzerland. Unity of command was not achieved, except in appearance. Nivelle's plan was to strike at the German centre; Haig was to aid him by simultaneous attack, though Haig's own prepossessions were

in favour of freeing the Channel ports by a burst from the Ypres salient. In the result, neither plan succeeded. Nivelle failed because neither the French Government nor a section of the French soldiery would bear a repetition of the losses incurred in his thrust at the Chemin-des-Dames; Haig failed because he had neither the time nor the weather in which to drive his last blows home in the autumn of the year.

A contributory cause of the comparative failure of the Franco-British plan of campaign in 1917 was the want of perception of the intention of the Germans to withdraw from the positions in the Somme area which they had defended so stubbornly in 1916, and which the Allies were preparing to render untenable or to batter down. The want of perception was not complete, but both British and French plans were upset by the suddenness and extent of the withdrawal, which the Germans effected with much less loss than they should have been forced to sustain. The first symptom of the general withdrawal was discovered in March, when portions of St. Pierre Vaast Wood, near the junction of the French and British lines, were found to be evacuated. By 17th March the German voluntary retirement was in full swing, and their forces ruined everything as they retreated. By 17th March, also, the British front from Roye to Arras was moving forward, and on 2nd April the Fifth Army was within two miles of St. Quentin, while the Fourth Army on 5th and 6th April was at Ronsoy and Lempire. While the British armies were pushing towards the Cambrai-St. Quentin line the French were pushing on a 30-mile front from the north of the Upper Somme, towards the new German line from St. Quentin, behind Soissons, in front of the St. Gobain plateau, the Forest of Coucy, and the Chemin-des-Dames. Behind the new line Nivelle matured reconstructed plans for the great French attack towards Laon.

Of the new fortress line (the Hindenburg and Drocourt-Quéant line) which the Germans had constructed and continued to improve, the La Fère-Laon position and the Chemin-des-Dames were the southern bastion, and the Vimy Ridge the north-western pillar. Sir Douglas Haig's preconceived plan had been to attack the Arras front, not in order to assault this line, but as preliminary to the Ypres salient thrust farther north. Nevertheless, the plan could be adapted and it was prosecuted. Preparations on a large scale, equivalent to building a counter-fortress front, had been made for the Arras operations, and the greatest precautions were taken to lend the attack all the support which mines and artillery could give. Two armies, the First (General Horne) and Third (General Allenby), were prepared for this action. Horne's

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army made its attack on the Vimy Ridge, with the Canadian Corps as shock troops, on 9th April, and the attack was extended on a 12-mile front from Hénin-sur-Cojeul, south-east of Arras, to Givenchy-en-Gohelle, north of Arras. The Canadians took the whole of Vimy Ridge, except its northern end, the conquest of which was completed next day. Five villages fell into British hands and 6000 prisoners. Subsequent days saw the extension of the victory, but though Vimy village, Givenchy-en-Gohelle, and other important points were taken, the fortified villages of Hénin and Wancourt held out by dint of machine-guns, and prevented the possibility of the Third Army's joining hands with the Fifth Army beyond the third line of the German defences until it was too late. The whole of the expected gains were therefore not realized, but the possession of the Vimy Ridge was invaluable, and became a most important factor in stemming Ludendorff's rush in 1918, when he attacked the Third Army after destroying the Fifth.

The British attacks did not end on 11th April, as they should have done, but were continued here, as well as at other portions of the British line to its junction with the French armies, in order to lend assistance to Nivelle while his attack in Champagne was in progress. It was a very costly procedure, and its scope may be inferred from the statement that on 23rd April a "second phase of the battle of Arras" began; another 12-mile front east of Arras was launched on 3rd May; and there were bloody encounters about Bullecourt or Fontaine-les-Croiselles on 7th and 12th, 15th and 16th, and 21st May. Some 20,000 German prisoners were captured in these preliminary spring operations, but the drainage in casualties to the British armies was heavy, and more damaging still was the loss of time by the postponement of Field-Marshal Haig's major plan farther north.

Thus, however, was at last begun on 7th June by the assault on the Messines-Wytchacte Ridge, which, under the name of the 'Battle of Messines' denotes one of the most completely successful actions fought in that year. It was undertaken by the Second Army (General Plumer), and the preparation for it, including the mining of the ridge, had been as near perfection as possible. The attack was launched; the mines which blew the German front line to pieces were exploded on the morning of 7th June at ten minutes past three. Nine miles of front were stormed and 6400 prisoners taken. In the next week the number of prisoners was considerably augmented; German counter-attacks were beaten off; and the captured position enlarged and firmly consolidated.

From this time forward the operations of the

British armies may be envisaged as an attempt to enlarge the great bulge of the Ypres salient by fighting their way up to and along the ridges which enclosed it, so as to force the Germans to relinquish their hold on the coast near Nieuport, Zeebrugge, and Ostend. One very awkward spoke was put in the British wheel by an attack (10th July) on the extreme coastal sector of Lombaertzyde and the mouth of the Yser, by which any combined sea and land attack that might have been projected by the British was discounted. Most of the positions were recovered, but the amphibious plan had perforce to be postponed.

The putting into effect of Sir Douglas Haig's major plan, after the preliminary step of the capture of the Messines Ridge had been taken, did not operate till 31st July, when the 'Third Battle of Ypres' began, with a combined British and French attack on a 15-mile front beyond Boesinghe, on the Yser-Ypres Canal, to Zillebeke. The attack was conducted by the First French Army (General Anthoine); the bulk of the fighting fell on the Fifth British Army (General Gough). Twelve villages were taken and 5000 prisoners. There was, and could be, no break-through. The Germans rallied to a counter-attack, and were able to do so because their defences, their concrete pill-boxes, and their machine-gun effectiveness could, and did, hold up attacks before they progressed too far.

The rest of the British campaign in 1917 till it was arrested by the torrential rains of a wet October, and by the mud of the impossible declivities, may be summed up as a series of desperate forward thrusts which exacted each its toll of prisoners, ground, and positions, but none of which succeeded in its object of inflicting a lethal injury on the German resistance. In the end these attacks had to cease while the last fragment of coveted ridge, the Passchendaele spur, was still not won, because on that ridge, as elsewhere, though blood had been poured out like water, and losses endured with unflinching fortitude, flesh and blood could do no more. The chief actions were as follows:

15th Aug.—British attack on wide front from north-west of Lens to Bois Hugo, north-east of Loos. Enemy's position penetrated to 1 mile depth.

10th Aug.—Franco-British attack on 9-mile front north of Ypres-Menin road. British carry Langemark.

15th to 21st Sept.—Second phase of third battle of Ypres. 3000 Germans captured.

4th Oct.—British advance on 8-mile front, anticipating German attack east of Ypres. 3000 German prisoners.

9th Oct.—Third phase of third battle of Ypres.

One mile advance on Passchendaele Ridge. 2000 prisoners.

6th Nov.—British attack on Ypres Ridges. Canadians capture Passchendaele.

These attacks were interspersed with costly minor encounters, and by the repulse or endurance of counter-attacks. The battle may be said to have closed by stress of weather in mid-November.

It was followed on 20th Nov. by a British attack of an altogether different kind, in an unexpected quarter—at Cambrai. Here the Third Army, under General Byng, made an attack on a 10-mile front between St. Quentin and the River Scarpe—tanks being employed for the first time in large numbers to lead the advance without a preliminary bombardment. It was a complete surprise, and all but a complete success. The 'Hindenburg Line' was broken, numerous villages and 8000 prisoners were taken. If the cavalry had been up, as they ought to have been, a first-class disaster might have been inflicted on the Germans, and their railway communications at this point broken. But the cavalry were late; the next few days were spent in consolidation by peculiarly hard fighting; and on 30th Nov. the Germans counter-attacked and subjected the British defences of the newly-created salient at Bournon Wood and Moeuvres to almost as severe a surprise as they had sustained ten days before. The British lost a number of prisoners, and had eventually to evacuate most of their hard-won positions.

#### *French Front in the West, 1917*

The history of the French armies in 1917 is largely the history of Nivelle's frustrated attempt to pierce the German centre between Soissons and Rheims in April; the pause necessitated by the fact that it was felt impossible to press the French armies too hard or too soon after the disappointment of the attenuated success at the Chemin-des-Dames, where the chief sacrifices of the attack took place; and the efforts on a more moderate scale by General Pétain, who succeeded Nivelle, to win tactical victories at a moderate cost on the terrain acquired in the April adventure. The second battle of the Aisne, as Nivelle's offensive was called, was planned over a length of 50 miles from La Fère, on the Oise, round the edges of the Forest of Gobain and Coucy, to Laffaux, thence below the line of the Chemin-des-Dames ridge and behind the Aisne to the crossing of the river at Berry-au-Bac, and Brimont, near Nogent-l'Abbesse, to the Moronvilliers heights on the other side of Rheims.

The attack on the larger part of this line began

on 10th April; that on the Moronvilliers sector on 17th April. The attack on the 10th was extremely costly; it succeeded in only part of its objectives, but it captured 11,000 prisoners. The next day, one of pouring rain, improved on the positions won, especially at the western end of the Chemin-des-Dames, and on the 18th and 19th Nivelle so far enlarged his successes as almost to give them the appearance of a great victory. But the French bolt had been shot, and, to put it plainly, Nivelle was not encouraged to go on. By the 28th he had taken 28,000 prisoners, 175 guns, and some of the strongest points on the heights of the Aisne; but everywhere the positions had been only half-won, and the temper of the French army as a whole had suffered too severe a test. Nivelle was succeeded by Pétain and his plan was abandoned. The rest of the year was occupied by General Pétain in very skilled attempts, named limited offensives, to repel the Germans from disparting some of the positions won and to enlarge the French gains at other points. The chief engagements were as follows:

5th May.—The French, co-operating with the British on a 20-mile front north of the Aisne, take Craonne and 6000 prisoners.

20th Aug.—French carry enemy defences north of Verdun on 11-mile front; 6000 prisoners. By 28th Aug. the French were back at their original Verdun positions.

23rd Oct.—French advance on the Aisne north-east of Soissons on 6-mile front; 8000 prisoners. By 25th Oct. further 3000 prisoners and 100 guns were taken.

#### *The Balkans, 1917*

In the Balkans the military situation during 1917 remained much as the end of 1916 had left it, the Germans, as already mentioned, completing their conquest of Roumania, and the Allies remaining comparatively inactive in the field while they cleared up the extremely unsatisfactory situation in Greece. The chief operations consisted of a Franco-Serbian attack north of Monastir, and attacks by General Milne on the British front in the Struma valley; but though the situation remained in the field virtually unchanged, the political situation was vitally affected in 1917 by the deposition of King Constantine in favour of his second son, Alexander—the king being induced to abdicate on 12th June—and the formation of a new Government under M. Venizelos. From 30th June, Greece, having formally severed diplomatic relations with Germany, was at length added to the list of countries fighting on the Allies' side.

#### *Italian Campaign, 1917*

Italy, who, meantime, had proclaimed Albania an independent state under Italian protection, and occupied Yanina in June, 1917, had committed herself wholly to the Allies' cause in 1916 by declaring war on Germany on 28th Aug. It was in Aug., 1917 that Ludendorff began his preparations for the terrific blow which was to lead to the Italian disaster at Caporetto in October. During the earlier months of the year the initiative had remained with the Italians, and Cadorna had used it in a series of offensives which, while carrying him farther across the Carso towards Trieste, and winning seemingly impregnable positions in the Trentino, together with upwards of 30,000 prisoners and 140 guns, were indecisive, and left his exhausted troops—reduced by some 150,000 casualties—ripe for the blow which Ludendorff had prepared for them. The Russian Revolution and the collapse of Roumania freed Austria-Hungary at the same time from any anxieties on her Galicia front, so that she could concentrate all her energies and the bulk of her armies against the Italians. When the enemy's great counter-stroke was delivered on 24th Oct., the control of the campaign was taken over by the German High Command. Ludendorff had been training picked troops in special tactics—to be developed at their full strength on the Western front in the following year—and von Below was transferred from the French front to take command. Following an intense bombardment, the Austro-German troops were launched against the Second Italian Army between Zaga and Auzza, in deep formations so closely packed that the way could not be lost amid the prevailing snow and rain. Taken by surprise, and seriously demoralized in parts by Bolshevik propaganda and enemy intrigue, the Second Italian Army, which had hitherto distinguished itself by its splendid courage, found the whole of its left wing giving way before the impact, thus opening a gap for the enemy 20 miles wide over the Julian and Carnic Passes. Having shattered both the first and second Italian lines at Caporetto and Vodil Vrh, the Germans and Austrians surged forward from the Tolmino bridge-head until the retreating Italians, becoming entangled with their own reserves, broke in disorder. Although the right wing of the Second Army held, and many heroic efforts were made by isolated units, General Cadorna decided that it was impossible to save the situation from irretrievable disaster except by a general retreat to the Piave line. This was ordered on 26th Oct., when the broken fragments of the Second Army, as well as the Italian Third Army, began the great retreat which will be remembered as one

of the finest achievements in Italian military history. The territorial gains of over two years' fighting had already been lost, and the conquering invaders reached within 15 miles of Venice, but they never succeeded in making the disaster irremediable. General Cadorna's scathing Order of the Day denouncing the units of the Second Army which had let the enemy through, and the new sense of national unity inspired by the military crisis, did their work. By 8th Nov. the bulk of the Italian armies, now in orderly retreat, were across the Piave, and two days later were ready to turn on their pursuers. The danger was not yet over; the enemy succeeded in carrying several further heights dominating the Venetian plain between the Piave and the Brenta; but by 21st Nov., when a last German attack was made on the Monfenera Ridge, and defeated, the invaders were for the time being held. They claimed some 250,000 prisoners and 1800 guns of every calibre, besides immense quantities of munitions. They had also succeeded in diverting French and British divisions from the Western front, the Allies sending what assistance they could to stave off the defeat of Italy. The French and British troops arrived in time for the winter struggle, which began on 4th Dec., by which time General von Below had returned to France—being succeeded in command of the Austro-German operations by General Krobattin—and General Cadorna had been transferred to the Allied War Council, his place as Italian Commander-in-Chief being taken by General Diaz. Two British divisions, under Cavan, took up their positions in the Italian line at Montellu; the French divisions at Monte Tomba; and they served to relieve the pressure while the enemy was making his last efforts to break through before the long-delayed snows put an end to the struggle for the year.

#### *Naval War in 1917*

At sea, where the British Grand Fleet was now commanded by Sir David Beatty in place of Sir John Jellicoe, who had succeeded Sir Henry Jackson as First Sea Lord in the previous November, the year 1917 passed without a single outstanding engagement. Since Jutland, the German High Seas Fleet had run no risk above water of again seriously challenging Britain's sovereignty of the sea, though her submarine campaign was pursued with ever-increasing vindictiveness. Risking rupture with the United States and other neutrals whose shipping and subjects were thus exposed to wanton attack, she inaugurated 'unrestricted' U-boat war on 1st Feb. "Give us two months of this", said the German Foreign Secretary to the American Ambassador in Berlin, "and we

shall end the war and make peace." The argument was that the Allies' losses in tonnage, already more than they could bear, would increase to such an extent that they would be starved into submission. The United States, with President Wilson as spokesman, replied by severing diplomatic relations with Germany, but it was not until 5th April that she formally declared war against her. Cuba followed suit on 5th April; Panama three days later; Brazil on 2nd June. Germany could afford the risk of offending the smaller American republics, but her defiance of the United States was a fatal blunder. She relied on her submarines to prevent the transport of American troops across the Atlantic—at least until they were too late to affect the issue. The first American contingents crossed unharmed and arrived in France on 26th June. It was not until the following year, however, that the new American army was ready to throw its weight into the scales on the Western front. The naval resources of the United States were at once placed at the Allies' disposal, the American destroyer squadron in particular being of great service in helping in the protection of trade off the Irish coast. Proof of the closeness of co-operation between the British and United States navies was afforded in June, 1917, when Vice-Admiral Sims, commanding the United States Naval Forces in European Waters, was given the command of the Irish station during the absence of Vice-Admiral Bayley on sick leave. No foreign naval officer had ever previously held the command of British ships, as well as his own, off the British coast.

Apart from the relentless submarine campaign, which every week exacted heavy toll yet never brought the Allies within measurable distance of the starvation-point to which the Germans had been so sure of reducing them, the enemy's operations at sea were restricted to destroyer and torpedo-boat raids in the Channel from Zeebrugge. Some of these did a certain amount of damage to patrol boats, and bombarded Ramsgate, Broadstairs, and Margate (27th Feb. and 20th April) with little effect save the death of women and children. One memorable incident in these minor operations in 1917 was the raid on Dover on the night of 20th–21st April, when 6 German destroyers, after firing a number of rounds inland, were caught on their way back by the British destroyers *Broke* (Commander R. G. E. Evans) and *Swift* (Commander A. M. Peck)—the advance ships of the British destroyer guard in the Straits of Dover. The *Swift*, which was leading, dashed between two of the retreating destroyers and, turning, sent one of them to the bottom with a torpedo. The *Broke* rammed the third vessel, and while the

two ships were locked, an old-fashioned hand-to-hand fight took place on the *Broke's* fore-castle, in which the German crew were beaten back. Two minutes later the *Broke* wrenched herself free and the German destroyer sank. Ten German officers and 108 men were rescued at the close of this dashing affair.

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#### *1918 on the European Fronts*

*First Phase of Ludendorff's Offensive.*—The Bolshevik betrayal of the Allies at Brest-Litovsk, the treaty of which took Russia irrevocably out of the conflict, and released Germany's Eastern forces for a concentrated assault in the West, gave the Central Powers their greatest opportunity of winning the war since their first hopes were shattered on the Marne in 1914. The crushing defeat of Italy at Caporetto afforded them further grounds for confidence. America, it was true, had thrown in her lot on the side of the Allies, but Germany counted on striking her decisive blow before the American troops could arrive in sufficient numbers to matter; and she had not yet lost faith in her submarines. All through the winter of 1917-8 Ludendorff, the German Commander-in-Chief, was secretly training his troops in the new tactics which were to bring open warfare into full play again, equipping them with Teutonic completeness, and massing guns and ammunition proportionate to the task in view.

The Allies on the Western front were meantime forced to remain on the defensive until such time as the American reinforcements should arrive in sufficient numbers to enable them to regain the initiative. Since April, 1917, the British army had borne the chief burden of the war in the West, and "the bloody struggles to conquer the Flanders ridges"—the words are those of Sir Douglas Haig himself—as well as the prolonged fight at Cambrai, "had left the army at low ebb in regard both to training and numbers". In view of the expected German offensive, it became imperative to fill up the ranks as rapidly as possible, and place the line in a sound state of defence. Late in Jan., 1918, Sir Douglas Haig took over a new stretch of French line, extending the front of the Fifth Army to cover the village of Barisis, 7 miles south of the Oise. The additional line, taken over somewhat against Haig's judgment, and giving the Fifth Army, which stretched on the left as far as Gouzencourt, no less than 42 miles to guard, extended the British front, all told, to 125 miles. The whole of this had to be greatly strengthened and supported by prepared positions to which the troops could retreat when the expected German drive took place, for it was regarded as inevitable that some dent must

result in the Allies' line where the colossal blow was dealt. This constructional work called for every man who could be spared for the task, and seriously interfered with the necessary training of the troops in new tactics of defence.

The months preceding the 'hammer blow' were marked by intense raiding activity on both sides, chiefly undertaken to procure information, but sometimes to secure useful positions for subsequent events. The most important of these included the sanguinary struggles for Bullecourt in the early days of January, in which the Australians greatly distinguished themselves, and German attacks at Dixmude (6th March), and in the region of Houthulst Forest and the Menin road (8th March), for positions destined to play their part in the new attempt to reach the Channel ports. By the middle of February, when 28 additional German divisions had arrived from the Russian front, and 6 from Italy, and great supply dumps were springing up in all directions behind the German lines—but particularly opposite the British Third Army at Cambrai and the British Fifth Army to the south of it—Sir Douglas Haig had no doubt as to what was to come. The only questions were "Where?" and "When?"

All strategical considerations pointed to an attack on the Fifth Army south of Arras, with the object of separating the British and French armies and seizing the centre of communications at Amiens. Neither the British nor the French Head-quarters Staff, therefore, was taken un-awares when the great offensive began on 21st March. Both had worked out plans to meet it. More than half Sir Douglas Haig's infantry and the whole of his cavalry were allocated to this sector's defence, and General Pétain had arranged to send a French army corps to their assistance in case of need. The final dispositions of the Germans were carried out with the utmost secrecy: sunken roads, bivouacs, and every device of camouflage being employed to conceal their last stages of concentration. Even so, Sir Douglas Haig learnt from his Intelligence Department on 19th March that the enemy was putting the finishing touches to his impending attack, and that it would be launched by the 21st, if not before.

It was heralded, in fact, at 5 a.m. on the 21st by an intense bombardment in a thick mist which made it impossible for the British batteries to render effective aid to the battered first-line trenches. The onslaught was organized in two parts, the northern advance being directed against Byng's Third Army from the Sensée River to the Cambrai road, and the southern attack from the Mesquière salient opposite Cambrai to St. Quentin. No fewer than 40 German divisions—nearly half a million men—specially

trained for the new offensive, were launched against this southern half, and of these more than half were directed against the 16,500 yards of front held by Gough's Fifth Army nearest St. Quentin. All told, the German drive consisted of 64 divisions on the opening day of the offensive. To meet it the British had but 19 infantry divisions in line and 10 in reserve, with cavalry. From first to last the Germans employed in this attack some 78 divisions—exceeding in numbers the total fighting strength of the whole of the British armies in France. By the 9th of April, when the Germans, foiled in the opening move of their supreme offensive, had shifted the spear-head of their assault to Flanders, the total number of British divisions employed both in cavalry and infantry did not exceed 46.

Some part of the line was bound to give before the terrific impact of the infantry attack which followed the bombardment on 21st March. The plans made for repairing the breach in co-operation with the French broke down for a time because the British Fifth Army, attacked by a far greater force than had been anticipated—23 German divisions having been massed as secretly as possible in order to bring them into position at the critical hour—had been forced back sooner than was expected. There was no time either for the British reserves or the French reinforcements to repair the breach before the assaulting divisions under von Hutier, who had established his reputation for this form of operation on the Eastern front, were through it and extending it in all directions.

There were, in point of fact, two serious breaches along the 42-mile front held by the Fifth Army. One, the less dangerous of the two, was south of the Oise, where the line was held more lightly than elsewhere, owing to the marshes, which had been relied on to make any considerable attack at this point unlikely. As ill luck would have it, a long spell of dry weather had made the ground easily passable, and the Germans, well aware of the position, swept across it in overwhelming force, like a tidal wave. Heroic stands were made for the forward redoubts and battle positions, but the whole of the ground south of the St. Crozat Canal was so submerged in the flood that by nightfall there was nothing for it but to withdraw the divisions of the 3rd Corps, which had been defending it, to the line of the Somme Canal. Nevertheless, though the Germans made their greatest progress on the 21st at this point, it was not their most dangerous thrust, being nearest to French reinforcements.

The chief danger-point was farther north, on the Fifth Army's left, below the Flesquières salient. By noon, with the fog still so thick

that it was impossible to see 50 yards ahead, the Germans had advanced as far as Ronsoy, inside the second zone of the British defensive positions, together with Hargicourt and Villers to the south. This opened a gate to the third line 8 miles wide, and before the day was over the enemy had pushed towards this as far as Templeux-le-Gérard. But for the stubborn defence of Epéhy, to the north, and Le Verguier, to the south, the breach would have been perilously widened on the following day, but at both these points the German advance was temporarily checked. It could not be stayed long. Supplied with an overpowering weight of men to crush through anywhere, von Hutier was ready to pay the price exacted for every success by British artillery-fire at short range, and British machine-gun posts held to the last; and when St. Émile and Hervilly finally fell on the 21st, Epéhy and Le Verguier could only hold out long enough for the general line of defence to be withdrawn from them. The retreat thence, hard-pressed as it was, left the Fifth Army's centre with a sagging flank to the south, of which the on-coming Germans did not fail to take full advantage. Thenceforward the tide swept on for days in ever-increasing volume, all the reinforcements that Sir Douglas Haig or Pétain could send serving only to stop gaps here and there. Ham, Bapaume, and Péronne had fallen by the 24th, and about two-thirds of the territory wrested from the Germans in 1916 regained by them. Germany was announcing to all the world that the 'Kaiser's Battle', as the emperor himself had caused it to be named, had already been won. To drive the news home, the enemy, on 23rd March, began bombarding Paris with long-range guns capable of firing 70 miles. Nesle and Noyon were the next to go, and by 26th March—save at Albert, which held out until the following day—the Allies were back beyond the line from which they started in 1916.

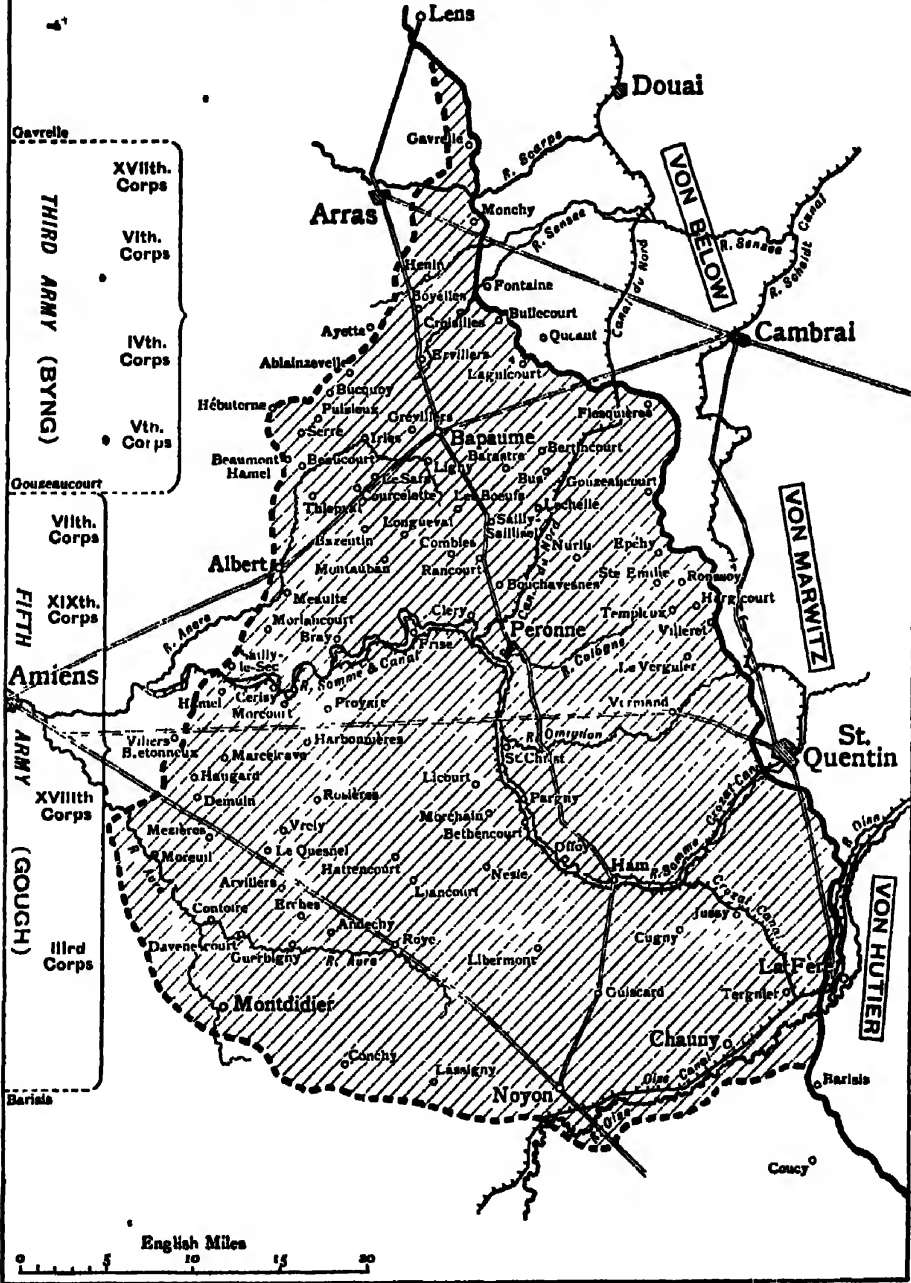
Elsewhere the enemy's progress along the 60-mile battle front had been slow and costly. He had least success in the north against the British Third Army, partly because the positions held were stronger, partly because his heaviest and most persistent blows had been reserved for the Fifth Army. Some isolated gaps were made on this front, but nothing beyond repair, and the ground lost was not vital. It is impossible in the space at our command to follow all the complications of attack and counter-attack in the fateful days which followed, until, by 26th March, the Germans were within a dozen miles or so of Amiens, with the British Fifth Army still retiring before them in a state of disintegration. At this critical juncture, when the reserves had all been thrown in, General Gough adopted a suggestion made by General



**Map showing the  
GERMAN ADVANCE and the BRITISH RETREAT**

between March 21st. & March 28th. and the line finally re-established on April 4th. & 5th. 1918

Line of March 21st.. ~~Line of March 21st.~~ Line of April 5th. ~~Line of April 5th.~~



Grant, Chief Engineer of the Fifth Army, that a last line of defence—a forlorn hope to save Amiens—should be formed from stragglers, army school personnel, tunnelling companies, Canadian and American engineers, anyone, in short, who could be roped in. The command of this heterogeneous force, after being organized by General Grant and posted according to General Gough's instructions, was handed over to General Sandeman Carey. 'Carey's force', as it came to be called, aided by the 1st Cavalry Division, which was rushed across the Somme from the north at the same time, earned a special tribute from Mr. Lloyd George in the House of Commons for the magnificent fight which it put up in this last line of defence.

The German effort was becoming spent, though by broadening out the salient the enemy continued to press back the French as well as the British. The French Third Army, sent to the assistance of the British Fifth Army, played a lion's part in preventing him from extending his gains too dangerously in the south. On the 28th he concentrated his main energy against the stubborn British Third Army, which, conforming to the retreating line of the Fifth Army on its right, had fallen back to new battle positions, but in good order. Fresh shock-divisions were brought up to break this northern pivot of the British defence, and, after the usual full-dress bombardment, were launched as before in continual waves of assault. This time, however, there was no fog to handicap the British gunners, who were given the opportunity of a lifetime when they opened fire from hidden positions on scerried ranks of German infantrymen, marching shoulder to shoulder at point-blank range. Six times the advance was renewed, and as many times mowed down, and when a final attempt was made, after a second bombardment in the afternoon, it met with similar failure. The Germans had shot their bolt. Their appalling losses on the 28th told on all their subsequent efforts in this first and greatest of Ludendorff's offensives in 1918.

It was on the 28th that General Gough relinquished the command of the British Fifth Army, General Rawlinson (Fourth Army) succeeding to the task of extricating its shattered divisions. Two days earlier the long-needed decision had been made by which the command of the Allied armies passed into the hands of General Foch as Generalissimo, who thenceforward, until the end of the war, held supreme control. Though several anxious days were to pass before the Allies could breathe freely again in the Amiens area, the position hourly improved as reinforcements, French and British, arrived on the scene. Counter-attacks recovered some of the ground on 30th March, and when the Germans resumed

their advance towards Amiens on a more limited scale on 4th and 5th April, their losses were out of all proportion to their gains.

### *Second Phase of Ludendorff's Offensive*

It is probable that the operations of 4th and 5th April were designed chiefly to pin the British armies to the southern area, while Ludendorff, finding his road barred to Amiens, prepared to strike a fresh blow in the north in a decisive bid for the Channel ports. Though well aware of a possible thrust in this direction, Sir Douglas Haig had been compelled to draw heavily on his Flanders front for reinforcements during the exhausting battle for Amiens, in which as many as 46 out of his total 58 divisions had been engaged. By the end of the first week in April the bulk of the British troops holding the Flanders line had passed through the furnace of the southern battlefield and were sadly in need of rest and reinforcement. Had the ground been in its usual condition of slush and mire at this season of the year they could have been relied upon to hold up any advance, but a dry spring had prepared the path for a German advance, and as soon as this was seen to be imminent it was reluctantly decided voluntarily to evacuate the Passchendaele salient, won at such frightful cost in the closing months of the previous year. Steps were also taken to relieve the Portuguese troops<sup>1</sup> who, though not seriously engaged, had been too long in the trenches south of the salient. Before either of these plans could mature the Germans upset both by launching their great attack at 4 a.m. on 9th April.

As in the opening move against the Fifth Army on 21st March, the assault—launched by the army of General von Quast in the direction of Festubert-Armentières against the northern portion of the front held by the British First Army (General Horne)—was favoured by an impenetrable early-morning fog. Through it came five columns of troops like the prongs of a fork, with an army corps as the central point to thrust into the weak spot where the Portuguese were sandwiched in between the British 40th and 55th Divisions. Bursting through the Portuguese sector, the attack spread swiftly to north and south—especially to the north, where the 40th Division, feeling the thrust which pierced the Portuguese line, was forced back on its right flank to the line of the Lys, 3½ miles in its rear. The rest of the 40th, with reinforcements from the 34th Division,

<sup>1</sup> Portugal was drawn into the war on the side of the Allies on 19th March, 1916, when Germany declared war on her, ostensibly because she had requisitioned German merchant ships lying in her harbours, but in reality because an invasion of Mozambique was then becoming necessary to Germany's hard-pressed troops in East Africa.

formed a new line between Fort Rompre and Bois Greulier, covering Erquinghem and Armentières from the south, and held it the rest of the day. Had the southern pivot also given way when the Portuguese sector was broken the consequences would have been fatal to any hope of checking the German onrush. But the 55th Division never budged after its left flank, borne back by the first assault, succeeded in forming a defensive flank between Festubert and Le Tourret, and the importance of its stout defence through the battle, as Sir Douglas Haig bore witness in his dispatches, could not be over-estimated. This line was strengthened later in the day by the 21st Division, which, together with the 50th Division—both just relieved from the Somme fighting—had been hurried up as soon as the attack developed.

Next day the battle spread to the north, blazing up along the right of the British Second Army (General Plumer), the army of General Sixt von Armin attacking in another early-morning mist between Armentières and Hollebeke. The two German armies now acted in concert, and together pushed their advantage until the Lys was crossed in the south and the Messines Ridge carried in the north, with Laventie, Ploegsteert, and a dozen other historic landmarks in between. Outflanked on both sides, Armentières had perforce to be evacuated. Messines was recaptured by the South Africans, but had to be abandoned when the enemy's advance in the south pushed almost as far as Neuve Eglise. On the 11th, when the enemy continued to extend his gains with seemingly endless reinforcements, and had crossed the Lawe, a tributary of the Lys, Sir Douglas Haig issued his famous Order of the Day to his troops, which, while it reflected the gravity of the situation, inspired them to fight it out:

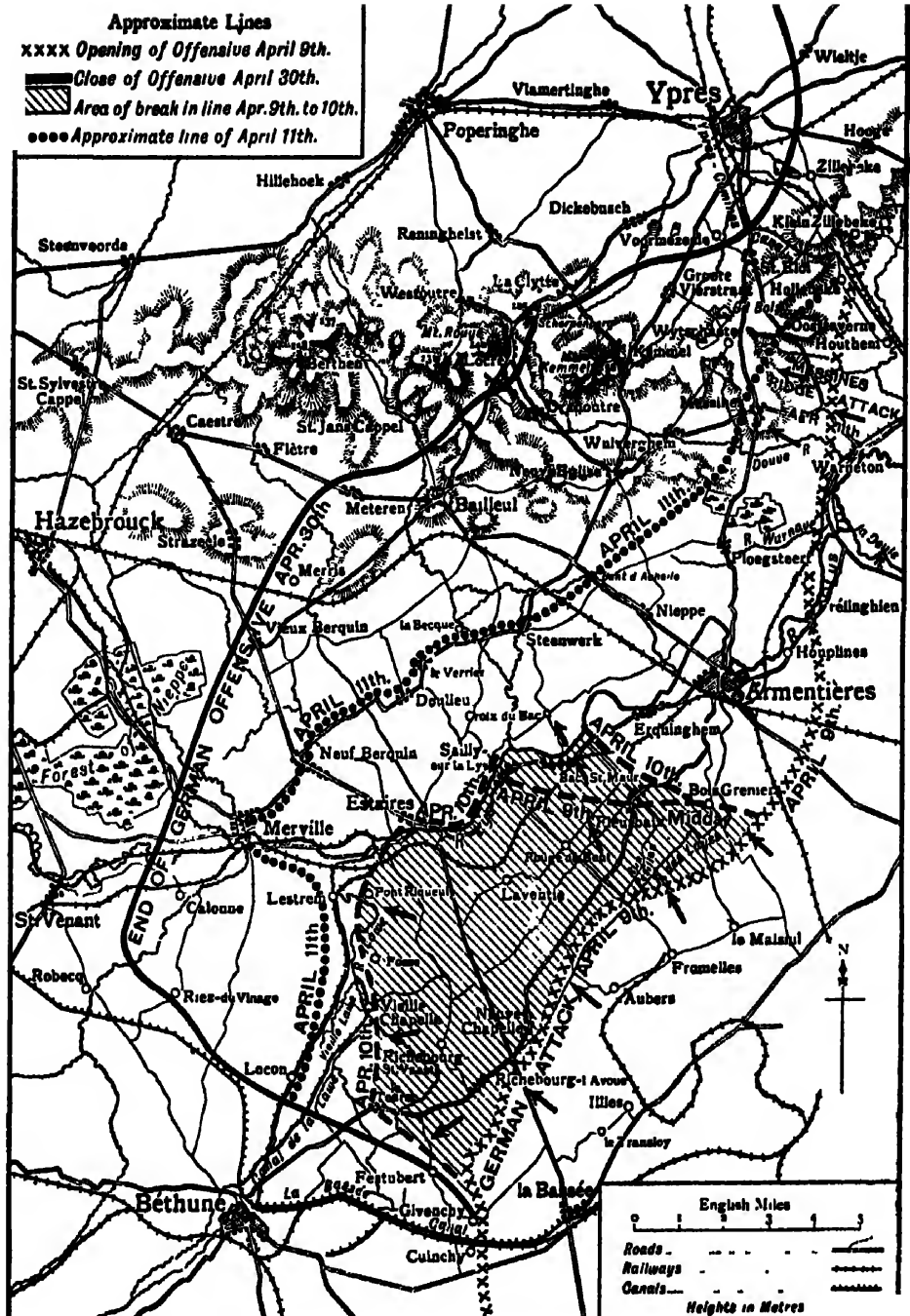
"Every position must be held to the last man. . . . With our backs to the wall, and believing in the justice of our cause, each one of us must fight on to the end. The safety of our homes and the freedom of mankind depend alike upon the conduct of each one of us at this critical moment."

The appeal, with its promise also of speedy reinforcements from the French army—"moving rapidly and in great force to our support"—heartened the battle-worn divisions when they sorely needed its encouragement. The pressure was still too great to prevent the Germans from taking Neuve Eglise on the 14th—after a struggle lasting two and a half days, from house to house—or Merris a day earlier, which brought them within 4 miles of Hazebrouck, where the 1st Australian Division, just detained, kept them at bay; or Bailleul on the 15th. At midnight on the 15th the British line fell back to the defences between Meteren and Dranoutre, a move involving the simultaneous withdrawal from the Passchendaele Ridge.

These were the darkest hours of the last great battle for Ypres. There were already signs that the German advance, having again failed to break a way through by sheer weight and numbers, was slowing down, and the promised French reinforcements were close at hand. These took over the sector from Meteren to Wytschacte, where, on the 25th, before they had consolidated their positions, they were made to bear the brunt of a fresh German blow, delivered with 9 fresh divisions, from Bailleul to the Ypres-Comines Canal. The French fought desperately to save Kemmel Hill, commanding Ypres some six miles away; but in five hours the Germans had captured both the village and the crest of the hill. With the Ypres salient now dominated both from Kemmel and Messines it became necessary still further to shorten the line round Ypres. This was accordingly redrawn on the night of 26th-27th April through Pilkem, Wieltje, Zillebeke Lake, and Voornezele.

One more effort was made by the Germans to push right through before the end of the month—on the 20th, when, in a fresh attack in force on the Franco-British front, they succeeded in reaching as far as Loere, behind Kemmel. But the French, who were in no mood to repeat their experience at Kemmel, flung the enemy back with sanguinary losses. The heaviest casualties of the Germans that day, however, were against the British 21st, 49th, and 25th Divisions, whose artillery—like the gunners of the Third Army on 28th March—had the range of them as they advanced in mass formation, and blew them to pieces. Only one of the waves of German infantry succeeded in reaching the British positions, where bomb and bayonet completed its destruction. This marked the last serious attempt on Germany's part to seize the Channel ports.

Though Ludendorff had failed to reach his objectives either on the Amiens or Flanders front he still had a sufficient superiority of force to retain the initiative. With every incentive to compel a decision before the new American army, which was now arriving at the rate of something like 150,000 a month, could enter the field in full strength, Ludendorff had either to throw up the sponge or strike again at the earliest moment in one final effort to beat the Allies to their knees. Meantime the obvious policy on the Franco-British part was to maintain an active defence until their own and American reinforcements made a counter-offensive possible. In the minor operations which marked this period of waiting, the Australians added Villers-Bretonneux to their battle honours. Villers-Bretonneux, which lies on the edge of the ridge facing Amiens—only 8 miles away—had been rushed and captured by the Germans



Germany's Last Bid for the Channel Ports: approximate positions of the Allies' line before and after Ludendorff's offensive in April, 1918

in a surprise attack in thick fog on 23rd April. Before daybreak the next morning the Austrians had surrounded the German garrison, and the end of a fierce house-to-house conflict left the place in British hands again, together with nearly 1000 prisoners.

### *\*Third Phase of Ludendorff's Offensive*

Though every day added to the danger of delay, it was not until the end of May that the German army, its plans disorganized by its unexpectedly heavy commitments in the Amiens and Flanders battles, was launched on the third and final phase of Ludendorff's great offensive with a sudden attack on the Aisne front in the direction of Paris. It was along this front that the 9th British Corps (General Sir A. Hamilton-Gordon), consisting of the 8th, 21st, 25th, and 50th Divisions, and subsequently reinforced by the 19th Division, had been sent to the French armies under General Pétain for much-needed rest after sharing to the full the honours and sacrifices of the earlier battles. By their side were crack French divisions which had also earned the rest which it was felt they could count upon along the main stretch of the Chemin-des-Dames, holding as it did some of the strongest natural defences along the whole battle front. The French had taken months in the previous year, and spent countless lives, to recapture these positions.

The very unlikelihood of choosing such a formidable sector decided Ludendorff to select it for his dramatic attack on 27th May, moving up his specially trained divisions of shock troops at the last moment—with all possible secrecy, accompanied by other surprises in the vast number of guns and aeroplanes brought into action, as well as the largest fleet of German tanks which the enemy had ever employed. Only on the very eve of the new advance did the French learn of the impending blow—too late to avert disaster. Outnumbered by 6 to 1 the Allies, British and French alike, were borne back by the onrush of picked troops as soon as the preliminary bombardment ceased. Helped as usual by a thick early-morning mist the armies of von Böhn, von Hutier, and von Below—all nominally under the German Crown Prince—had carried the whole of the Chemin-des-Dames ridge by nightfall, and were fighting on the Aisne. Within two days they were not only across the Aisne on an 18-mile front, but had swept on to the Vesle, and were even across that river west of Fismes—a depth of 12 miles from their starting-point.

Reserving his stoutest resistance for the flanks, Foch strove hard to save Soissons, but it fell again into the enemy's hands on the 29th, by

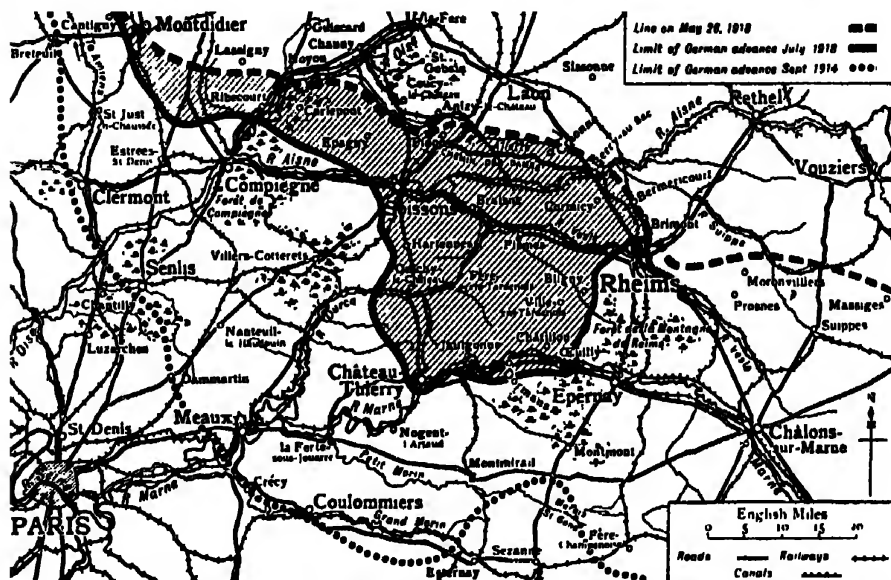
which date Rheims, on the Allies' right, was also pressed so hard that its outlying positions were carried on the 30th, and only the devoted bravery of Berthelot's Fifth Army—with Goutraud guarding the Champagne front on its right—saved the battered city. The British and French divisions which had meantime been driven back from the Chemin-des-Dames to the Aisne, and from the Aisne to the Vesle—the Allies often fighting side by side in hopeless rear-guard actions against immensely superior numbers—were now holding a line between the Vesle and the Ardre while the Germans continued to plunge deeper and deeper into the big salient which they had formed towards the Marne. The shattered divisions of the British 9th Corps now formed part of Berthelot's Fifth French Army guarding Rheims, and subsequently played a large part in repelling the enemy's attack on the north-east side of that city. In the words of General Berthelot himself: "They have enabled us to establish a barrier against which the hostile waves have beaten themselves in vain. This none of the French who witnessed it will ever forget."

By 31st May the German advance in the centre had spread as far as the Marne at Château-Thierry, extending thence along a 10-mile front to Dormans. It was at Château-Thierry on this day that the Americans began to play their part in the battle, linking up with a French colonial division on the south bank of the river and preventing the enemy from crossing. New French units were also coming into line, blocking the Germans' path south of Soissons on the road to Villers-Cotterets, as well as at Château-Thierry. Foiled in both these directions, Ludendorff turned to the Ailette front in order to get more elbow-room, and flattened out the French front between Soissons and Noyon. Again unable to make much further headway against the fierce French counter-attacks, he carried the battle still farther to his right, attacking between Noyon and Montdidier on 9th June in the hope of linking up the new Marne salient with the one already formed at Amiens, and so advancing on one immense front. The new 'drive' was again entrusted to von Hutier, whose 25 divisions, employing the same shock tactics as before, swept forward at first to a depth of some 5 miles in the centre; but, held on the wings, were fiercely counter-attacked on the 11th on their exposed right flank and robbed of most of their gains.

On the following day the German War Minister declared that "Foch's so-called Army of Reserve exists no more"; the truth being that Foch, with time and an ever-flowing stream of reinforcements on his side, was gradually becoming master of the situation, and could afford to wait until Luden-

dorff gave him the opportunity he wanted. Ludendorff, on the other hand, with the pick of his troops 'pocketed' in the great Marne salient, was forced to make another forward move or withdraw them. He made one more attempt on Rheims, three divisions being ordered on 18th June to take it at all costs; but the whole attack was an expensive failure. For the rest of the month, when the weather broke, and during the first half of July, Ludendorff left most of the fighting to the Allies while he prepared for one last herculean effort to burst through their line.

and von Mudra advanced, they found that Gouraud's army, save for volunteer garrisons in concrete forts, had returned undamaged to its main battle positions, to reach which they had to face a concentrated fire that tore their ranks to pieces. Some 50,000 German troops were admitted to have fallen that day before Gouraud's army. With the failure of the advance in Champagne the German attack on the right, where Italian as well as British and American troops were now fighting side by side with the French, was unavailing, though the line south-west of



The First and Last Advances on Paris: map showing approximately (by the shaded area) the limit of the German gains in the final phase of Ludendorff's offensive in 1918, and (by the dotted line) the limit reached in the 1914 advance

On 28th June Foch felt his way towards his counter-stroke by a preliminary advance between Villers-Cotterets and the Aisne, when he won back over a mile of useful territory and took over 1000 prisoners. On 4th July further minor victories were recorded along both the French and British fronts, the British success being at Hamel, where American units celebrated Independence Day by helping the Australians to recover that fiercely-contested stronghold, with 1500 prisoners.

On 15th July Ludendorff launched his final effort on a 50-mile front on each side of Rheims. This time the Allies were warned of its direction in time. On the left, where immediate success was vital to the whole plan, the attack was flung into disorder at the very beginning by a deluge of shells from Gouraud's guns before even the German bombardment started; and when, this over, the attacking divisions of von Einem

Rheims was pressed back some 3 or 4 miles, and eight divisions under von Böhn succeeded by 17th July in crossing the Marne at a number of points between Fossoy and Dormans.

#### *Foch's Counter-stroke*

They were only allowed to remain south of the Marne long enough for Foch to convert these river crossings into a death-trap. For Foch had now decided that the moment had come when the Germans, exhausted by their advance, were least in a condition to resist a counter-stroke aimed at their flank. The flank which Foch selected for attack was that on the western side of the salient created, from its most northerly point on the Aisne near Soissons, to its southern extremity, Château-Thierry on the Marne, where the symptoms of the exhaustion of the

German momentum had been furnished by the ability of American and other contingents to resist further advance. In the earlier half of July a ceaseless stream of men and guns had flowed up from the French side to take cover in the forest of Villers-Cotterets on their flank, in preparation for the blow to come; and by 18th July two French armies were assembled along the 27-mile flank, that of General Mangin aligned between the Aisne and the Oureq, which bisected the salient, and that of General Degoutte from the Oureq to the Marne. Mangin's army contained some of the finest French shock divisions as well as two famous British ones, the 34th and the 15th, and a number of keen American troops. Degoutte's army had the more awkward task, judged by the country over which it had to travel, but Foch's plan here, as elsewhere, was to put his best fighting material where it would pierce farthest, and hold the enemy elsewhere. By the same token the army of General Berthelot, with two other supporting British divisions, was entrusted with the task on the other side of the salient, from Rheims to Épernay, not of thrusting at the Germans but of holding them hard.

Mangin's army was ordered to strike with all its force. It was equipped with new and speedier 'whippet' tanks, and its immediate onset was masked by the accident of a July thunderstorm on the eve of the fighting. On the morning of 18th July it went forward with nothing but a barrage, but with the effect of a thunderbolt, and its average advance on that day was 5 miles, with Fontenoy and the plateau of Pernay on the Aisne firmly secured. Degoutte's army went forward for 2 miles over difficult country. A blow of immense significance had been struck along the whole length of the salient's vulnerable side. Next day Mangin's movement continued; he tightened his hold on the Aisne and swung his right wing farther along the Oureq so as to bring the whole line of the one good north-and-south road in the salient under the fire of his guns, and thus to hamper the German movements terribly. That alone would have forced the enemy to begin a retreat from the Marne, while it might yet be possible. Meanwhile Degoutte was advancing also, and was forcing the Germans away from the neighbourhood of Château-Thierry. The German commander, von Böhn, was not slow to recognize the implications of the situation into which Foch had forced him, and gave orders to recross the Marne. He was in time, but his retreating troops were roughly handled at the crossings, and despite all his attempts to hold up the attack on his western flank by counter-attack, the pressure of Mangin and Degoutte, added to that of de

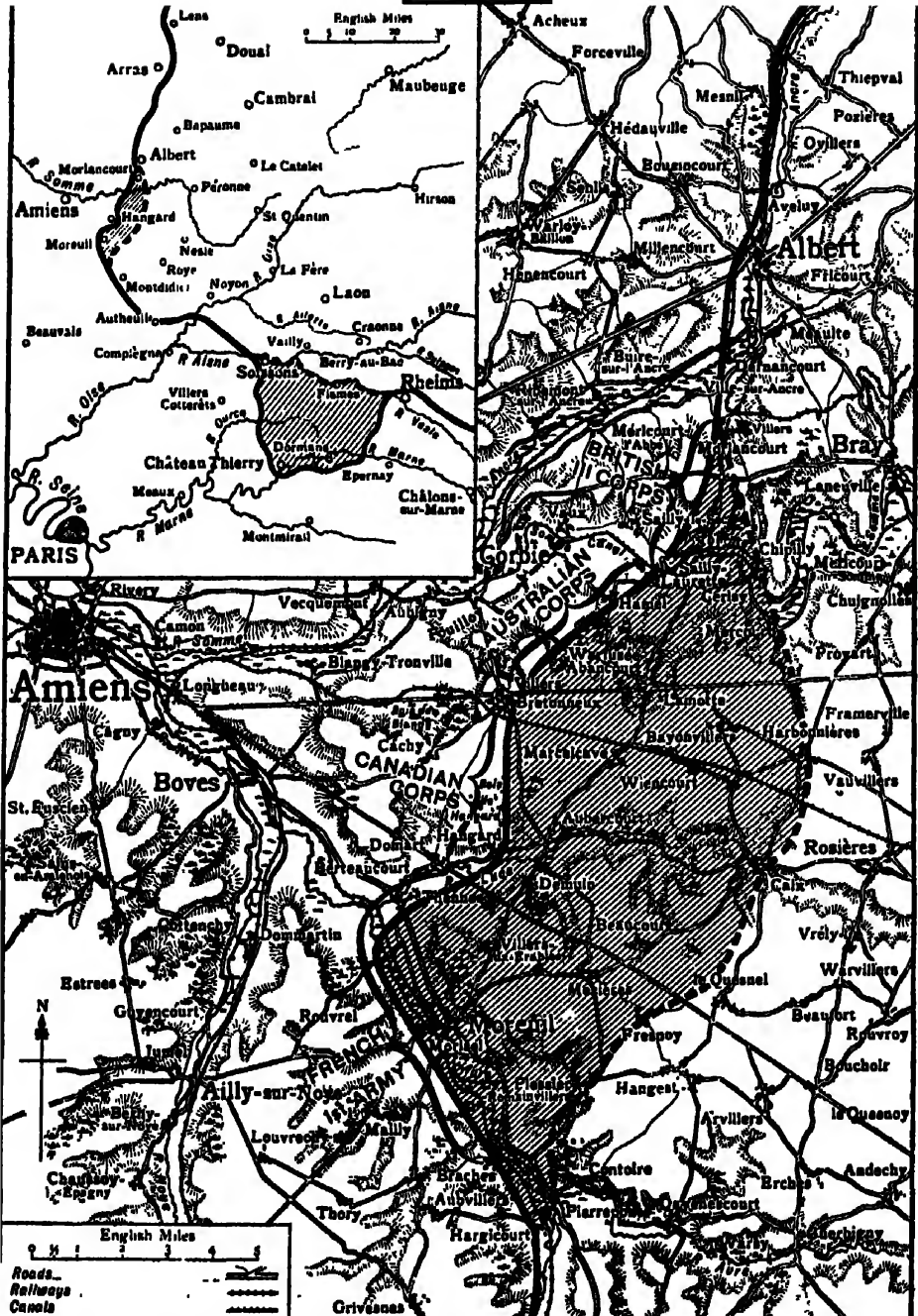
Mitry's army, which was now following him back over the Marne, became every hour more dangerous. By 20th July not only was the Marne itself in process of being abandoned by von Böhn but Château-Thierry had fallen. Degoutte's army was 3 miles north of it. De Mitry's divisions had secured ample crossings for future movement and Berthelot's mixed forces of French, British, and Italians had begun a disconcerting attack on the eastern side of the salient. In three days the Germans lost 20,000 prisoners, and, what was more significant, 450 guns. The first *riposte* of the French Generalissimo had been delivered. It was to be followed in unending succession by others.

The German Commander-in-Chief had to gain time. It was no easy thing to withdraw his 600,000 men crowded between the Aisne and the Marne, but he was obliged to support them lest the salient should collapse too suddenly. He aimed a counter-stroke at Gouraud's army east of Rheims, but the blow spent itself in the air, and Foch replied by setting in motion the army of General Debency, where it stood opposite to that of General Hutier, between Montdidier and Noyon. But he had not yet gathered the full fruits of the strength of his positional assault between the Aisne and the Marne, and did not in the least allow pressure here to relax. Mangin seized Oulchy-le-Château on the Oureq (25th July); and on 20th July Gouraud, on the other side of Rheims, recovered the ground he had ceded under the German pressure. By Sunday (28th July) the Allied attack in the Aisne-Marne salient had swept convergently on to the line of the Oureq, and with that achievement the most important episode in the opening of Foch's campaign was consummated. Soissons fell to Mangin on 1st and 2nd Aug., a signal that the work was done, and Foch was now free to prosecute his larger plan of delivering successive blows at points where they would disperse and use up the German reinforcements most effectively.

#### *The Allies' Victorious Offensive, 1918*

Marshal Foch, after consultation with the British Commander-in-Chief, had desired the commanders of all armies, British and French, to prepare plans of action and to be ready to put them into operation at short notice. He now more particularly addressed inquiry to Sir Douglas Haig as to his willingness to undertake a continuous offensive towards the German centre. Sir Douglas Haig assented to Marshal Foch's representations as to the superior advantages to be gained from an attack there, and, while continuing a show of preparation in the Ypres area, where Ludendorff, on an estimate of the psychology of the British commander, would expect





The Freeing of Amiens Map illustrating the recapture of the city's outer defence line on the opening day of the Battle of Amiens, 8th Aug., 1918

the counter-attack to come, and was already taking steps to reduce its effectiveness by masked withdrawals, transferred forces steadily to Rawlinson's Fourth Army on the Somme. This army, and the First French Army under Debeney on the right, both directed by Haig, were set in motion on 8th Aug. on a 16-mile front from Morlancourt to Moreuil. The thrust was successful beyond expectation. The British Fourth Army, on the right wing, went through the German divisions of von Marwitz (Second Army) like paper, regaining the old outer-line defences of Amiens; and Debeney's men crushing the resistance of von Hutier's Eighteenth German Army, and reaching Fresnoy and Plessier, where they linked up with General Humbert's Third French Army on the road to Roye. The captures of the day amounted to 17,000 prisoners and 500 guns, an unmistakable symptom that the German power of resistance was shaking.

On 9th Aug. Rawlinson pushed on still farther: on 10th Aug. General Humbert prolonged Debeney's still attacking line and took Montdidier, and a number of villages. These three armies continued to eat into the enemy's positions and to pin a number of German divisions down till 20th Aug., while Mangin's army at Soissons moved *en échelon* to take up contact with Humbert's right. Meanwhile Ludendorff, fully aware now that the initiative had passed out of his hands, and that the best course that lay open before him was a 'strategic retirement', began to effect one stage of it in the Ypres and Lys district under the direction of General Sixt von Armin, whose withdrawal was followed vigilantly by the British forces; and another stage in the German salient on the Ancre, where General von Below's Seventeenth Army was stationed. Von Below withdrew on the Bapaume line from Serre, Beaumont-Hamel, and Buequoy to the shelter of the sector of the Hindenburg line behind it (13th, 14th, and 15th Aug.).

But whereas in 1917 Ludendorff had disconcerted both British and French Commanders-in-Chief by a sudden withdrawal on the Bapaume-Péronne line of the Somme, he was not now allowed to withdraw without injury. Haig's battle of Bapaume (21st Aug. and following days) was designed in two stages, the first of which brought up Byng's Third Army to a position in which it was aligned with Rawlinson's Fourth Army, and the second of which saw the Third and Fourth Army attack von Below in combination. The combined pressure of these two armies was continuously successful, though the Germans fell back stubbornly in many places. By 30th Aug. Bapaume was once again in British hands, and the line of attack was threatening the strongholds of the Hindenburg line, while its

extension ran through Hendecourt and Fremicourt to Cléry. Péronne fell to the Australian Corps by a most gallant feat of arms on 1st Sept. A more strategically significant victory was gained on the same day when the capture of Bullecourt, followed by that of Riencourt and Cagnicourt, opened up the first crevice in the ramifications of the Hindenburg defences known as the Droocourt-Quéant switch line. The battle of Bapaume drove thirty-five German divisions from the old Somme battlefield, and captured 34,000 men and 27 guns.

The crevice in the Droocourt-Quéant defences was still further widened on 1st Sept., when six British divisions of Horne's First Army, including two Canadian, attacked behind tanks a 5-mile front occupied by eleven German divisions and captured Dury Ridge and Quéant, together with 16,000 men and 200 guns. So far, therefore, from Ludendorff's strategic retreat being conducted 'according to plan', it cost the Germans, between 21st Aug. and 9th Sept., some 53,000 men and 470 guns; the French had been able to occupy Ham and Chauny, while the British were going forward; and General Sixt von Armin was forced cautiously to retire from the Ypres salient.

During these operations by the British armies Foch had never relaxed pressure with the three armies of Debeney, Humbert, and Mangin, while still threatening an advance beyond the Vesle in the deflating Aisne salient, west of Rheims, and preparing new blows elsewhere. At the beginning of September the position of the French armies of the centre, won by continuous fighting, was as follows: Debeney had crossed the Somme, taken Ham, and was threatening St. Quentin; Humbert was close to Tergnier and was pointing towards La Fère; Mangin was back in Coucy-le-Château and held the railway thence to Soissons; Degoutte was spreading from Soissons along the Aisne. These threats left General Ludendorff no choice but to shorten his line where he could do so with least risk. He decided on the Vesle front, where General de Mitry, with French and Americans, had been engaging his Seventh and Ninth Armies, and began to retire thence on 4th and 5th Sept. on a 19-mile front. The Americans occupied the Aisne thereupon from Condé to Viel-Arey, and on 7th Sept. General Mangin crowned his long campaign at the Chemin-des-Dames by taking the ruined Fort de Condé. A week later Allemant and Laffaux Mill fell, and once again the French troops came in sight of Laon. Humbert and Debeney, both pushing forward, embarrassed Ludendorff in his intention of moving divisions to meet a new British movement known thereafter as the battle of Epéhy.

This battle was the preliminary movement in that great attack on the Hindenburg line which,

more than any other single action, was the decisive 'blow at the heart' of the German defensive plan. The British advance, viewed as one movement, was made towards Cambrai, which was the northern bastion of the German defensive lines, as La Fère and Laon were the twin southern pillars. On 2nd Sept. the Third Army began a local attack on a 5-mile front which captured Havrincourt and Trescault, while on the extreme right of the Fourth Army the 9th Army Corps and the Australian Corps began a movement which by 17th Sept. placed them in Maissemy, where the Fifth Army in March had been pierced. These preliminary positions having been secured, the Third and Fourth Armies set in motion their important combined attack (18th Sept.) on a 17-mile front from Gouzeaucourt, through Havrincourt to Holnon Wood, where Debeney's First Army lent assistance. The hardest fighting was at Epéhy, which gives its name to the battle, on the left centre, but by nightfall the German defences had been pierced on a 3-mile front, 12,000 prisoners had been taken, and the British forces brought within striking distance of the main Hindenburg lines.

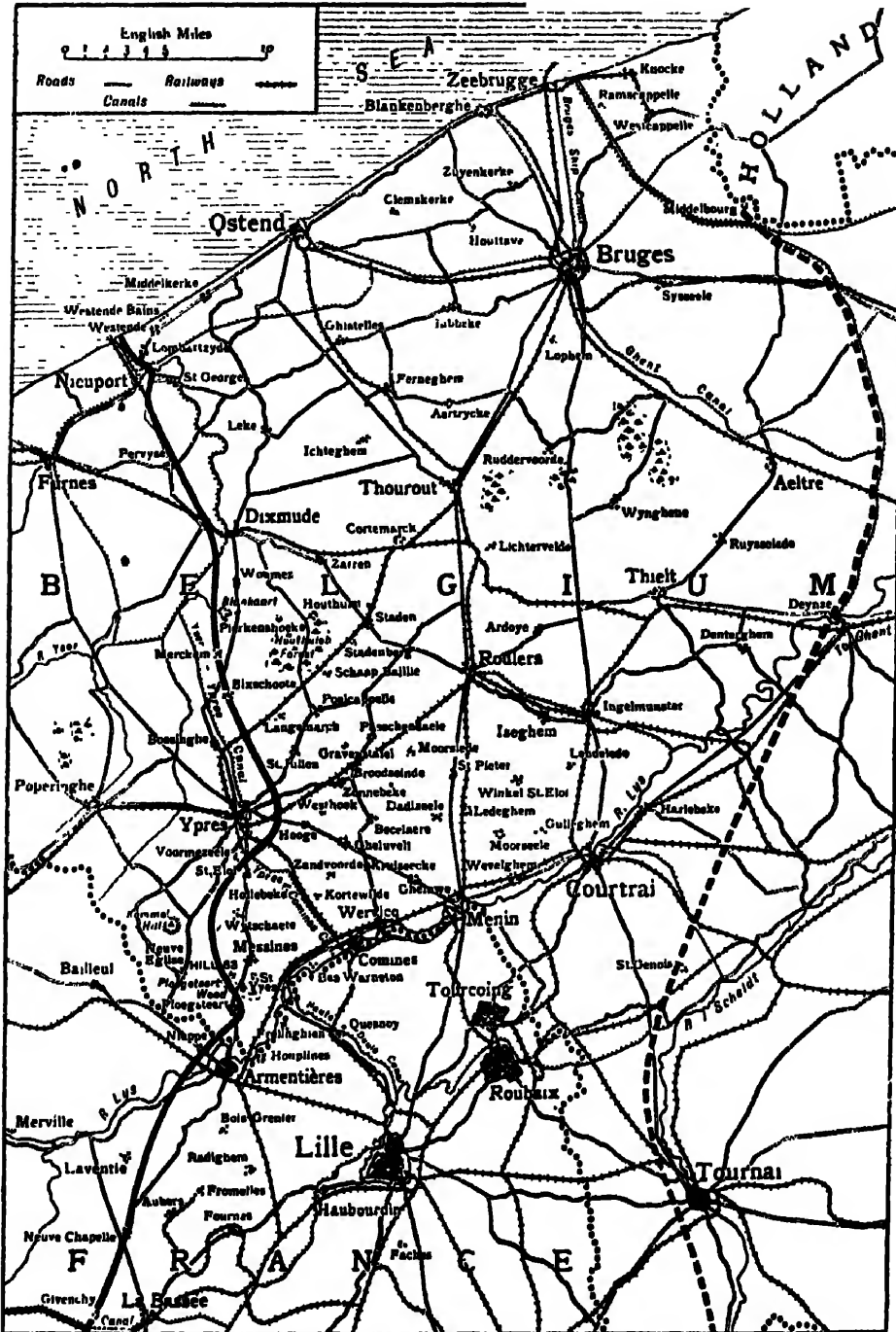
During the weeks in September while the plans for the battle of Epéhy were ripening, Foch had struck hard at another point in the German line, which had appeared invulnerable while the Germans were strong, but was now a menace to Ludendorff's own plans for retirement because it absorbed divisions which he badly needed elsewhere, namely the long-standing salient of St. Mihiel. It was held by seven German and two Austro-Hungarian divisions in September, and Ludendorff had been withdrawing its heavy artillery; but before his plans for withdrawal could be consummated, Foch sent in General Pershing with his young American divisions, aided by two French divisions, at the salient's apex. The Americans attacked on the two faces of the salient, west and south, the strongest thrust being made by two corps of seven divisions apiece on the southern face. The attack began on 12th Sept., and in thirty hours the salient had disappeared; while in spite of the haste with which the Germans had left it—the firmest resistance was offered by the two Austro-Hungarian divisions on the western face—10,000 prisoners and 450 guns were left behind. This victory, as symptomatic as others of German disorder, freed the Verdun-Commercy railway, and completed the attenuation of Ludendorff's reserves. The 207 German divisions which Ludendorff had commanded at the period of the greatest German strength had fallen to 185, and only 21 reserve divisions remained.

The second stage of Foch's plan now had been reached. The German armies had again been brought back to the line which they had chosen

in 1914, after their first rush had recoiled. It was less threatening by the loss of the St. Mihiel salient, but it had been enormously strengthened by four years of engineering. North of the defence line was the railway which, running through Brussels, Mons, Maubeuge, Mézières, Sedan, and Metz, was the chief artery of German communications, and Foch's plan was to cut this artery on either side of the great curve which the German line made when, after coming north to south from the coast, it turned west to east at La Fère. The right half of the thrust was to be made by Gouraud's army at Rheims and the Americans on the Argonne, where they were being steadily accumulated. The more deadly attack was to be made by the First, Third, and Fourth British, and the First French Armies, which should break through Cambrai and St. Quentin towards Maubeuge.

Complementary operations were designed for the armies of Humbert and Mangin at the nose of the curve, and it was expected that, under this comprehensive pressure, Ludendorff would be compelled to withdraw divisions from the coastal sector, where an attack by the British Second Army (Plumer) and the Belgian Army might then be successful against a weakened front. A portion of Degoutte's army was sent northward in readiness for such a blow, and to the Fifth British Army (now commanded by Birdwood) was assigned a task at Lille and Lens similar to that of Humbert and Mangin at St. Gobain.

There was a pause of nearly a week, in which the Germans awaited, and the Allies prepared the new move; and then, on 27th Sept., Haig's armies struck what Foch declared to be the blow from which there was no recovery. The battle of Epéhy had given the requisite positions for the attack on that section of the Hindenburg defences which the Germans named the Siegfried line. The plan was to send forward the First (Horne) and Third (Byng) British Armies to clear the way on a line from Sauchy-Lestrée to Gouzeaucourt, seizing the crossings of the Canal du Nord, and so preparing the way for an attack by the Fourth Army. The dangerous movement was accomplished (27th Sept.): the crossings seized, the canal held, and Cambrai threatened. On 29th Sept. the Fourth Army took up the combat, and in a tremendous action along a front of 20 miles, supported by attacks from the other British armies and the First French Army, got across the vital defences of the St. Quentin Canal in the Siegfried zone. The next day the fighting spread furiously along the front of all four armies: the breach was widened; a portion of the Scheldt Canal taken; and by 3rd Oct. the Fourth Army had pierced the Siegfried line vitally. By 9th Oct. the German defences

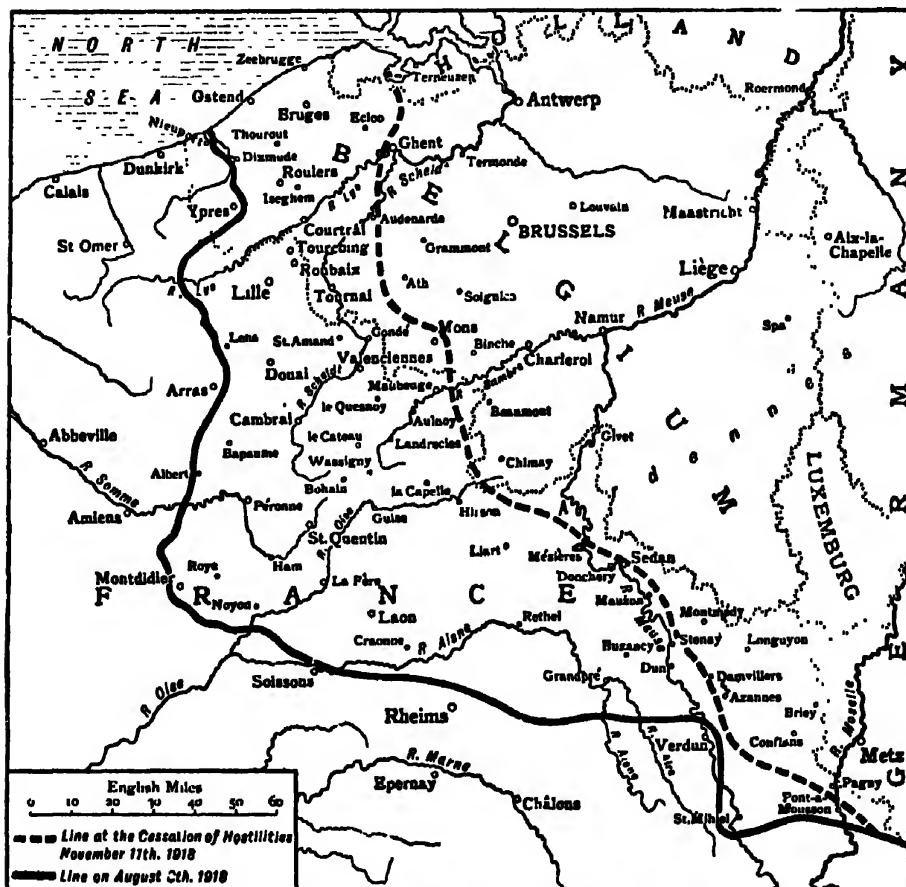


The Liberation of the Belgian Coast, 1918: map showing approximately the Allied line on 28th Sept.—represented by the solid line—and on 25th Oct.—represented by the broken line

were no longer defences, and in this decisive encounter they had lost 30,000 prisoners and 380 guns.

Elsewhere victories had been won which appear minor only by comparison. American divisions had been transferred to the left bank of the Meuse at Verdun, and, supported by French divisions, had carried Montfaucon and Varennes

Belgian-British attack on 28th Sept. the thinly held German front melted away. By nightfall the British held all the ridge between Wyttschaete and the canal north of Hollebeke; the Belgians were in Houthulst Forest. By the end of September the blood-drenched ridge of Passchendaele, and all its tragic surroundings, had passed into the Allies' hands, and the German grip on



Map showing approximately the Allied line on 8th Aug., 1918, and on Armistice Day, 11th Nov., 1918

(10,000 prisoners); on the other side of the Argonne Gouraud was advancing, and by 1st Oct. was 9 miles from his starting-point below Moronvilliers, and had accumulated 13,000 prisoners and 300 guns.

The results of these attacks were at once apparent, as Foch had predicted, in the north. His plan of an attack by Plumer's Second British Army, and by the Belgian Army stiffened by French divisions, was as successful as he had hoped. Under the weight of the Franco-

the coast had been finally unloosed. This marked the beginning of the end. Since Foch attacked between the Aisne and the Marne on 15th July the Allies had taken a quarter of a million prisoners, 3660 guns, and 23,000 machine-guns. The rest of the campaign must either be a disaster of the first magnitude to the Germans, or, at best, a painful and ineffective retreat to the line of the Meuse.

What remained of the campaign was the work of clearing up; but this was not an easy task,

because, though Ludendorff was aware that victory remained permanently with the Allies, he assured the German Government that delaying actions could be fought till the following spring. Against such an undesirable protraction of the war, Foch was preparing a final stroke in the neighbourhood of Metz with the aid of a Second American Army, which was being organized by General Pershing, who had relinquished the command of the First American Army to General Leggett. But the progress of the First American Army in the Argonne, where the fighting was conducted under circumstances of great difficulty, and where the transport was admittedly defective, was slow; and, lacking the place and the resources for another outflanking blow against the retreating German, the Allied armies could do no more than press their retreat.

That retreat position after position was forced from their hands. Cambrai fell on 9th Oct.; on 15th Oct. von Elzen's army was far from the coast; on 17th Oct. Ostend had fallen; Horne's First Army had taken Douai, and Birdwood's Second Army had liberated Lille. King Albert re-entered Bruges on 25th Oct. Farther south the British Third and Fourth Armies were close to Le Cateau on 17th Oct.; and Mangin and the French had re-entered Laon—so long as German Great Head-quarters—on 18th Oct. The story of the rest of the campaign, though it involved much severe fighting in breaking the resistance of German rear guards, is the record of the steady drive of all the British, French, and Belgian Armies which had produced the German collapse, while the right wing of Foch's greater pincers, comprising the only great new reinforcements he could bring to bear, namely, Gouraud with the Americans on the extreme right, worked its way up for a last decisive blow.

It was a slow operation; but by 4th Nov. Gouraud and Leggett had joined hands north of the Bourgogne Forest; and by 6th Nov. Gouraud entered Rethel and an American division reached Sedan. Thus, though behind schedule time, Foch's right wing approached its decisive position in the first week in November; and in the second week the left wing (British) had occupied Maubeuge. What would have been the consequence had Foch advanced his right wing further and with effect is a matter for the military expert. That Ludendorff was in no doubt of its disastrous results to the German armies is shown by his request for an Armistice on 9th Nov.

### *The Balkans, 1918*

Bulgaria, thoroughly war-weary, and dissatisfied with Germany's refusal to give her the whole of the Dobruđa when terms were made

with Roumania, had surrendered to the Allies on 30th Sept. The last Balkan campaign had been swift and decisive. No major operations had taken place during the earlier months of 1918, but on 15th Sept. General Franchet d'Esperey, who had succeeded General Sarrail in supreme command of the Allied forces, launched an offensive which rapidly transformed the whole military situation. French and Serbian troops, on the left or Monastir front, with the eager Serbians as the spear-head of the attack, penetrated the Bulgarian positions with an impetuosity which in two days carried them 12 miles behind the enemy's lines on a 22-mile front, and drove a wedge between the First and Second Bulgarian Armies. Meanwhile the British and Greek divisions were engaged in a far more difficult task on the Doiran front, where they suffered heavy losses in storming impregnable positions between the Dopololje Ridge and Vetrenik, but succeeded in preventing the Bulgarians opposing them from sending reinforcements to their hard-pressed troops along the Monastir front. This 'wing of sacrifice' plucked the Second Bulgarian Army to the Doiran front until it was too late to join its retreating First Army. Realizing the plight in which it stood, it hurriedly evacuated its positions on the night of 21st Sept. and fled in confusion towards Sofia. The pursuit of the Bulgarians was now taken up by all the Allied armies from Doiran to Monastir, the vengeful Serbians in particular harrying the retreating Second Army with a remorseless energy which drove it headlong through Northern Serbia in increasing disaster towards Belgrade, while the British and Greek forces under General Milne entered Bulgaria hard on the heels of the demoralized First Army. By 26th Sept. the Bulgarian politicians realized that the whole position was hopeless, and sent a *parlementaire* under a white flag to the Allied head-quarters. Four days later they signed an armistice at Salonika, handing over complete control of the Bulgarian railways and communications, demobilizing the Bulgarian armies, and surrendering their arms and ammunition. On 4th Oct. King Ferdinand abdicated, and his eldest son reigned in his stead as King Boris III.

### *Italian Campaign, 1918*

In less than a month—on 3rd Nov. to be exact—Austria-Hungary, after experiences in the field similar to those which had fallen to Bulgaria's lot, surrendered to the Italians. This turn of the tide in the Italian campaign in 1918, which amply atoned for the disaster of Caporetto in the preceding year, and crowned Italian arms with triumph, followed a final attempt of the

Austro-Hungarian army, now under the direction of General von Arz, to crush the Italian front in conjunction with Ludendorff's great offensive in the West. General von Arz's main attack was delivered on 15th June on a 46-mile front along the Piave, and extended across the mountain positions between the Piave and the Brenta. The two British divisions west of Asiago played a great part in hurling the enemy back in this sector, the French divisions similarly distinguishing themselves on their right. Elsewhere some progress was made at certain points, and the Piave was crossed in two places; but by the third day it was already obvious that the attack had failed. Then the weather broke; rainstorms swept down the hills and turned the Piave, which had been low when the enemy crossed, into full flood, sweeping away a number of his bridges. Hurried efforts were made to get the marooned troops back, and though General Diaz was unable to bring up enough divisions in time to complete their discomfiture, they lost heavily enough in the retreat, their casualties before the battle died down on the other side the river amounting to some 200,000. Biding his time for his own great counter-offensive until Foch could be assured about the situation in the West, where Italian troops distinguished themselves in the operations round Rheims, General Diaz gradually pushed the Austrians back, until by 7th July he had cleared the whole Piave delta. It was not until 24th Oct. that his final blow was delivered. Its success was immediate and overwhelming. Launched on the night of 23rd-24th Oct., the main attack consisted of an advance across the Piave with the Tenth Italian Army—placed under the command of Lord Cavan—now including three British divisions, together with the Eighth and Twelfth Italian Armies. Cavan's force formed the spear-head of the thrust, and ensured the success of the battle by seizing the Island of Grave di Papadopoli in the Piave mid-stream, held by the enemy as an advance post. This was captured in a daring surprise attack by night, without any artillery preparation, and paved the way for the passage of the troops across the swollen river. At the same time the Fourth Italian Army, with a French division, advanced across the old battle-ground of Asiago and Monte Grappa, where, however, the Austrians counter-attacked, holding up the advance until the whole front collapsed with the triumphant progress of the main attack across the Piave. By 27th Oct. the breach had widened until it spread across the entire front of the three Italian armies, which thereupon swept the plains and mountain heights until all the enemy's positions between the Brenta and the Piave had been regained. The Austrian retreat

became a rout. By the end of the month the Italians claimed 50,000 prisoners, had cut the railway between the plains and the mountains at Conegliano, and occupied Feltre. With Germany in similar plight; Turkey and Bulgaria already finished; and her own internal affairs rapidly going from bad to worse, Austria appealed to General Diaz for an armistice. When the end came on 3rd Nov. with the signing of the agreement which involved the demobilization of the Austrian army; the surrender of the Austrian fleet; the occupation by the Allies of the Trentino, the Istrian peninsula, and a portion of the Dalmatian coast and islands, the Italians had just captured both Trent and Trieste, a landing-force having arrived at Trieste for the occupation that very day. The wholesale nature of the Austro-Hungarian surrenders during the closing phase of this decisive campaign may be gauged from the fact that by 3rd Nov. they had amounted to no fewer than 300,000 prisoners and 5000 guns.

#### *Germany accepts Defeat*

The complete collapse of the Great War, and with it all the Pan-Germanic dreams of world-power, came with dramatic swiftness. Ludendorff resigned, and though the Kaiser had entreated Hindenburg to make one last stand on the line of the Meuse, his appeal had been in vain. Hindenburg knew the hopelessness of the position, not only of the German army but also of the German home front. Ominous disturbances were breaking out in all parts of the Fatherland, including a mutiny at Kiel. Turkey (30th Oct.) as well as Bulgaria and Austria-Hungary had surrendered, and Germany was in no position to face the Allies alone. The Armistice terms, with all their crushing humiliations, had perforce to be accepted, and were signed on 11th Nov. They included, besides evacuation of territory, the surrender of the bulk of the German navy, 5000 additional guns, 30,000 machine-guns, 3000 trench-mortars, and 2000 aeroplanes. A zone of territory on the Rhine was to be occupied by the Allies, and the Treaties of Brest-Litovsk (signed by the Bolshevik Government with the Central Powers on 3rd March, 1918, in defiance of Russia's solemn engagement not to make separate peace with them) and Bucharest (forced on Roumania in March, 1917, at the close of von Mackensen's drive) were declared null and void.

Unable to face his subjects, William II abdicated on 9th, slipped across the frontier into Holland on 10th Nov., and on the 28th of that month signed the formal document of his abdication, the Crown Prince, who also sought refuge in Holland, following suit three days



later. With the Kaiser fell all the rulers of the German states. On 10th Nov. the Imperial Chancellor, Prince Max of Baden, resigned in favour of Herr Friedrich Ebert, ex-shoemaker, who became 'First Imperial President of the German Republic', with a Government formed from both wings of the Socialist party.

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#### *Last Year of Naval War*

The war had been won at sea as well as on land, though the British navy had far fewer opportunities than the army of getting to grips with the enemy. The hazards of naval warfare never ceased by day or night; and by the end of the war the range of the submarine had extended from the eastern end of the Mediterranean to the American coast. All the reckless efforts of the Germans to win the war by these means failed. With the adoption of new methods to cope with the danger—including the employment of 'Q' boats, or mystery ships—and the invaluable help of the American reinforcements, the monthly shipping losses in the closing year of the war grew progressively less, falling, indeed, from the total of 1,404,473 tons in the September quarter of 1917, to 915,513 tons in the corresponding quarter of 1918. Meantime the new tonnage under construction to make good these losses was as rapidly increasing. The U-boat war, in short, had failed; and the Germans knew it had failed.

The outstanding operation at sea in the closing year of the war was the raid on Zeebrugge and Ostend on St. George's Day under Vice-Admiral Sir Roger Keyes, the object being to block the outlet of the German submarines and destroyers from their depot at Bruges. Since all the neighbouring coast was strongly fortified, the attack was fraught with the gravest danger, and had to take the Germans as far as possible by surprise. The chief ship of the expeditionary force was the old cruiser *Vindictive* (Captain Carpenter), which, with the ferry-boats *Iris II* and *Daffodil*, were told off to act as shield to the three blocking-ships intended for Zeebrugge—*Thetis*, *Intrepid*, and *Iphigenia*. Two old submarines were also taken, charged with explosives, and ordered to ram themselves below the viaduct connecting Zeebrugge Harbour with the Mole, and then blow themselves up. One of them carried out her orders to the letter; the other's rope parted while she was being towed into position, and she was too late to help. The simultaneous attempt to land, shortly after midnight, followed a bombardment from a squadron of monitors, and was supported by a flotilla of destroyers and a fleet of motor-boats. The *Vindictive* ran alongside the Mole within five minutes of being discovered by the German gar-

rison, and was kept in position by the *Daffodil* and *Iris* while landing-parties jumped ashore to do what damage they could and the blocking-ships were being rammed at the entrance. This successfully accomplished—both the *Intrepid* and *Iphigenia* being blown up in the fairway—the battered *Vindictive*, taking her landing-parties aboard, backed out and returned with her supports to Dover. The first attack on Ostend, which took place the same day, was a comparative failure owing to the undetected removal of a buoy, the two blocking-ships sent for the purpose being sunk outside the harbour. Three weeks later the commander of the *Brilliant* (Commander Godsal), who was in charge of that operation, tried again, this time successfully—the old *Vindictive*, patched up as a blocking-ship, being sunk 200 yards up the channel of Ostend—but Commander Godsal was killed by a shell just after completing his task.

The German navy made one more appearance on the high seas—when, under the terms of the Armistice, 6 battle-cruisers, 10 battleships, 8 light cruisers, 50 destroyers, and all her submarines were surrendered, the bulk of them to the Grand Fleet at Rosyth under Sir David Beatty on 21st Nov. On the following day the captive ships were sent to Scapa Flow, where, exactly seven months later, their German crews, while the British battle-fleet was absent on gunnery practice, scuttled practically every vessel. A week later—on 28th June, 1919—Germany signed the Peace Treaty at Versailles, involving unconditional acceptance of all the Allies' terms.

#### *Turkey and the War*

In Aug., 1914, the German war-ships *Goben* and *Breslau* escaped the British squadron stationed to intercept them near Messina, the escape arising partly through delay in correcting orders, and partly through the fact that the German commander had no scruple about violating neutrality in the course he sailed through the Straits of Messina. The ships reached the Dardanelles on 11th Aug., and were sold to Turkey. This was a symptom of Turkish relations with Germany rather than a determining cause of Turkey's entrance into the war as an ally of the Central Powers; but many efforts were made to change Turkey's attitude before the British, Russian, and French Ambassadors left Constantinople (1st and 2nd Nov.) and Great Britain declared war on her (5th Nov.). The first act of war undertaken by Turkey was the dispatch to the Caucasus front of three army corps, with a plan of campaign designed by General Liman von Sanders, and commanded by Enver Pasha. They were decisively beaten by the Russian forces at Sarikamish in December. Had the Russians possessed abundance of trans-

port, or had the roads been less difficult, this victory might have been pressed. But Russia wanted all her resources elsewhere, and it was not till 1916, two years later, that she made any serious attempt to carry the war into Turkish territory. Then, under the direction of the Grand Duke Nicholas, and General Yudenitch, who was some years later to come into prominence as the leader of an unsuccessful attempt to reach Petrograd and overthrow the Bolsheviks (1920), a Russian expedition drove back the Turkish forces on Erzerum and captured it (10th Feb., 1915). On 16th April, after another pause to gather transport, the Russians found their way to Trebizond on the Black Sea, and during the next few months spread over the Asiatic Peninsula to Bitlis, Musak, Van, Mosul, Erzingan, and Diarbekir, fighting generally with local success, but with no concerted plan of campaign. The effort expired in the autumn, and was not revived.

#### *Gallipoli Campaign*

Before, however, the Russians undertook their own expedition, they were urgent in pressing on France and Great Britain the desirability of opening up the Dardanelles so as to bring the Allies into touch with each other through the Black Sea ports. In response to this invitation, the naval possibilities of which were insufficiently considered by the advisers of the British Admiralty, and the prospects of which had been roundly condemned by all who had previously considered the problem, Admiral Carden began a bombardment of the Dardanelles forts with old battleships, British and French, on 19th Feb., 1915. The bombardment was renewed on 25th Feb. and 6th March. Admiral Carden resigned on 16th March owing to ill-health, and was succeeded by Admiral de Robeck, who favoured the idea of breaking into the Sea of Marmora by rushing the straits. Four big ships, one the *Queen Elizabeth*, engaged the guardian forts, Chanak and Kalid Bahr, at long range (18th March); other ships closed in, and a French squadron penetrated as far as Kephez Point. But the hidden batteries, the mines, and various other devices frustrated the attempt, which was a practical failure by the afternoon. Two good ships, *Irresistible* and *Inferible*, were put out of action, and two others, *Bouvet* and *Orran*, sunk. After this Admiral de Robeck accepted the professional view that a fleet operation should be combined with one on land. Lord Kitchener, who had been as little disposed towards the Dardanelles adventure as Lord Fisher, reluctantly consented, and General Sir Ian Hamilton was appointed to command the British expedition, while General d'Amade was in charge of the less numerous French Colonial Corps.

Sir Ian Hamilton's force eventually comprised the 29th Division, the Australian and New Zealand (Anzac) Corps, the East Lancashire Territorial Division, and part of the Royal Naval Division. There was an unfortunate delay in getting the expedition off from its Egyptian base, and the Turks had ample time to prepare for its landing (25th April), which they did not believe to be a possible feat. The landing was effected, nevertheless, with incomparable gallantry, at five beaches on the nose of the Gallipoli Peninsula, and at Gaba Tepe (by the Anzac Corps) farther north. Some 8000 men were got ashore in twelve hours, and an advance was made on the following day (26th April). On 28th April the French Corps, which had made a feint attack on the other side of the Narrows, was brought across to assist in a general advance on the dominating height of Achi Baba. The resulting engagement, the battle of Krithia, revealed the fact that the Turkish field fortifications, the Turkish artillery, and the Turkish numbers had all been too well organized under von Sanders to admit of being rushed. Evidence accumulated that Achi Baba, which was the key to the Dardanelles forts, could only be taken at ruinous cost by a frontal attack, though an attack in force on 6th May went nearer to success than any other, and appeared to fail only through a culminating misfortune of misdirected artillery. Fighting continued in May and June, both here and at Gaba Tepe, where General Birdwood commanded the Anzac Corps. Engagements in which local advances were made took place on 20th May (Anzac Corps), 4th and 21st June (French Corps), 28th June (29th Division), and though the climate and the insufficient protection inflicted appalling losses on the hard-trying British and French troops, it was on the Gallipoli Peninsula that the flower of the Turkish army also was lost. Of the naval forces the *Queen Elizabeth* was summarily ordered home just before a new Turco-German submarine campaign set in; three more old battleships were torpedoed; but the English submarines retaliated by torpedoing a Turkish battleship, gunboats, and transports in the Straits.

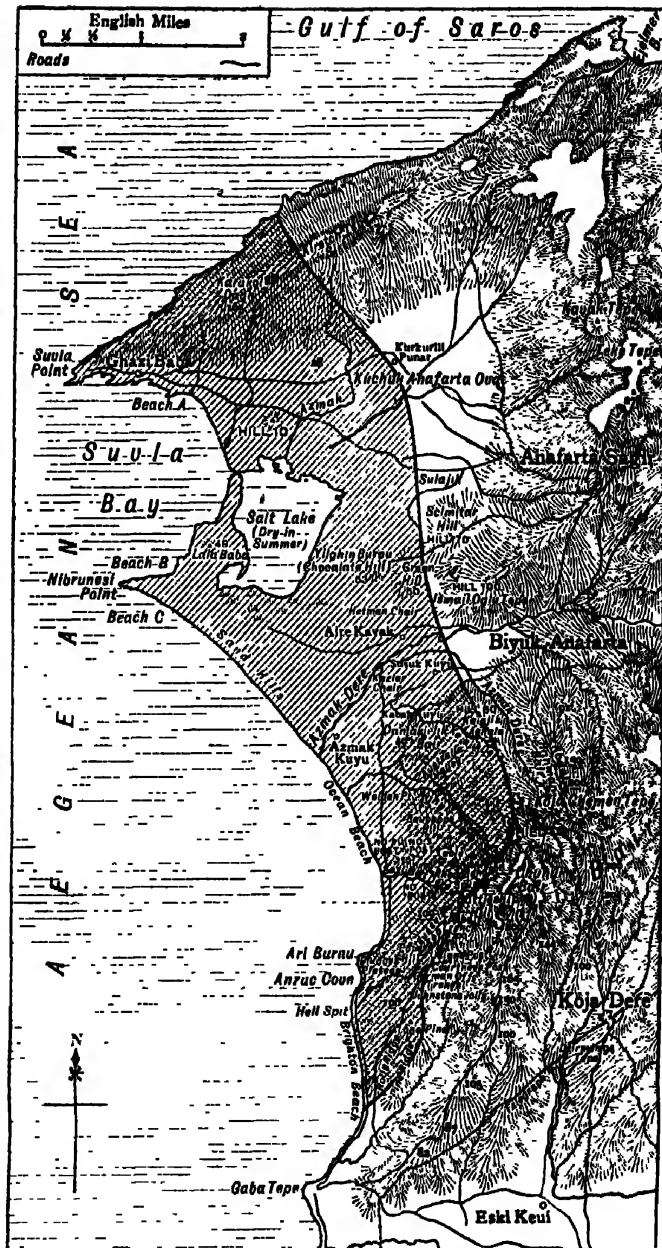
General Gouraud relieved General d'Amade in the middle of May, but was badly wounded by a shell (30th June), and returned to France. General Sir Ian Hamilton, who had unceasingly asked for more guns and more men, received some part of the aid he asked in order to put a new plan into operation. The plan was to land a force at Sari Bair, on the neck of the Peninsula, where it could co-operate with the Anzac Corps in forcing a way to the commanding heights there, and ultimately might take the Turks in the flank. One force was to land at Anzac Cove; two other of the three new divisions sent out to

Sir Ian Hamilton were to be landed 4 miles north, at Suvla Bay. The forces at Anzac were landed on 4th-6th Aug., bringing up the numbers of Sir W. Birdwood's command to 36,000. Sir F. Stopford was in command of the force to land at Suvla Bay (6th and 7th Aug.), with Generals Hammerley and Mahon as divisional generals.

The fresh attack on the night of 6th Aug. was not completely successful, and the Anzac columns under General Godley were still short of the ridges at Koja and Chunuk on the night of 7th Aug. The Turks were then alive to the threat, and made continuous counter-attacks, so that by 10th Aug. all the efforts of the combined force of Anzacs, Gurkhas, and English regiments had failed to maintain more than a slippery hold on the ridges. The chief cause of the failure was that the contributory aid of the attack at Suvla Bay further north had not been forthcoming, owing to various reasons. Lack of water had exhausted the unseasoned divisions landed in Suvla Bay; misunderstandings among the generals were other reasons; and when the Commander-in-Chief, on hearing of their failure, came up from Imbros, he met a situation which it was too late to redeem. General Stopford was succeeded by General de Lisle (15th Aug.). Lord

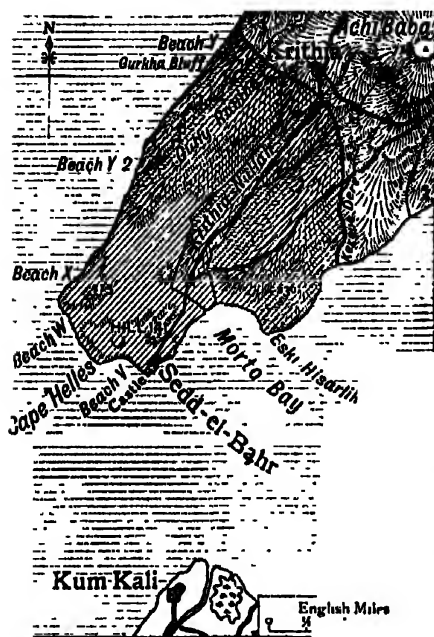
Kitchener declined to send further troops from home, and though Sir Ian Hamilton, bringing the veteran 29th Division up to Suvla, with

reinforcements of yeomanry, made another attempt on 21st Aug., it was unavailing. After 24th Aug. the British campaign assumed



The Suvla and Anzac Line map showing approximately by the shaded portion the area occupied after the linking up of the two armies in Aug., 1915

a defensive character, and in spite of Sir Ian Hamilton's representations the War Office declined to waste further men and material on it. On 15th Oct. Sir Ian Hamilton was recalled, and Sir Charles Monro, who reported that the expedition should be abandoned, was supported by Lord Kitchener after personal inspection of the surroundings. The evacuation



Map showing approximately the area in the Southern Zone evacuated in Jan., 1916

was carried out with remarkable success on 18th Dec. and 8th Jan. (1916). The cost of the expedition in men was 31,380 killed, 78,740 wounded, and 9708 missing.

### *Mesopotamian Campaign*

The Mesopotamian campaign ran contemporaneously in part with the Dardanelles operations, and in part with the campaign between Erzerum and the Caucasus in Armenia, in which Russia co-operated. A small British force, sent out to the Persian Gulf in 1914, occupied Basra (22nd Nov.) and pushed outposts forward to the junction of the Tigris and Euphrates. General Sir John Nixon took command (Jan., 1916), and in April (11th to 14th), following a Turkish attack, the British force, now a division strong, advanced to Shaiba, and on 31st May took Kurna. Amara, on the Tigris, capitulated to General Townshend (8rd June), who was empowered to push forward

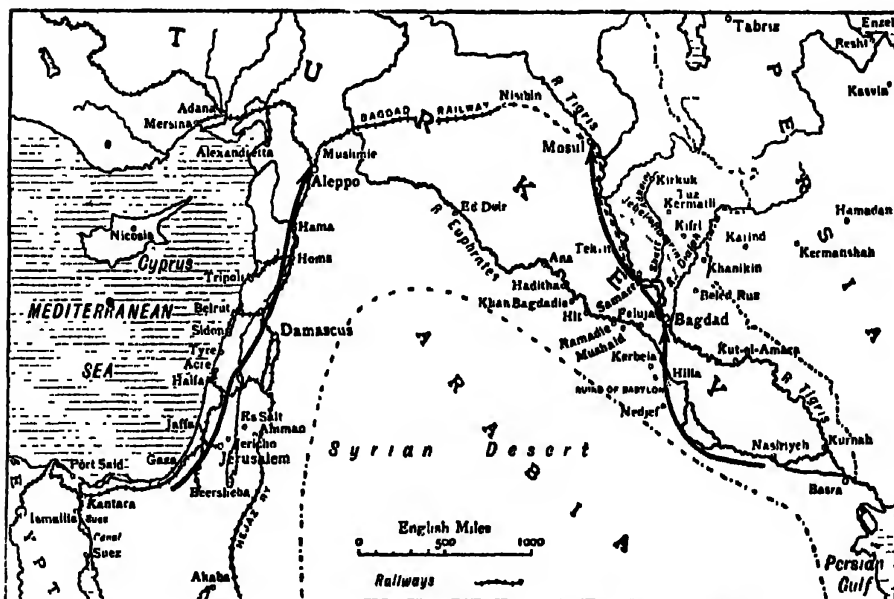
an advance column, while another column, under General Goringe, beat the Turks at Nasiriyah (24th July). At this time the Russians were on the headwaters of the Euphrates.

Fired by these successes, General Nixon ordered Townshend to seize Kut if possible. It was so dangerous an enterprise that probably the Turks did not believe that it would be attempted. But Townshend traversed the difficult country in six weeks, arriving within striking distance of the Turkish forces under Nur-ed-Din Bey on 15th Sept., and, in a very capably devised and executed engagement on 27th and 28th Sept., drove them before him. Townshend, against his own better judgment, was then sent forward to attempt the impossible feat of pushing on to the Turkish base of Bagdad. He arrived in front of their advanced position, Ctesiphon, on 22nd Nov., and attacked it with his four brigades, one of which was a reinforcement, and his rather scanty cavalry and artillery. The first line of the defences was carried, but Nur-ed-Din, who had retired on his supports, counter-attacked, and in spite of Townshend's resistance compelled him to retreat (25th Nov.) by way of Azizich, fighting heavy rear-guard actions all the way to Kut (8rd Dec.). Townshend's force suffered severely and lost part of its river transport. By 5th Dec. it was invested in Kut, and after two unsuccessful attempts to carry the town by force (8th and 23rd Dec.), the Turks sat down to starve it out. Townshend's mixed force of British and Indians, ill-fed and assailed by beri-beri and scurvy, endured the siege for 145 days, till 20th April, 1916, when it surrendered to Khalil Pasha. The prisoners were at first well treated, but most of them were compelled to march through Mesopotamia, Armenia, and Anatolia to prisoners' camps, and many died from their hardships.

An attempt to relieve Kut failed. It was made by Generals Aylmer and Younghusband, whose relief expedition set out on 3rd Jan., 1916. An engagement was fought on 8th Jan., and a pitched battle at the Shatt-el-Hai on 8th March. This failed, when on the brink of success, through want of luck or enterprise at the critical moment. Several changes were made in the Mesopotamia leadership after the impossibility of relieving Kut had become apparent, and in Aug., 1916, General Stanley Maude took over the command. The attention drawn to the blunders, and the scandals of medical assistance and transport, enabled General Maude to begin his task by rectifying them, and he built light railways from Basra. He made his first move forward on 12th Dec., 1916, and the history of the Mesopotamian campaign then entered on a brighter epoch, a result due to Maude's deliberate, bold, and prudent generalship. Contact began on 5th

Jan.; the right bank below Kut was cleared by 15th-16th Jan.; and by 23rd Feb. Kut itself was so far encircled that the Turks had no option but to abandon it with guns and prisoners. Maude resumed his advance on 5th March, and by 11th March had manœuvred the Turks out of Bagdad as he had forced them out of Kut. The integrity of the Mesopotamian Turkish force had been destroyed, and its portions distributed at points believed to be out of Maude's reach. One of these was at Hamadie, but a dashing night-march captured the Turkish commander

shall to beat off the attack with ease, but the raiders were not pursued. An attempt on a more concerted scale was made in 1916, though at this time the Turkish garrisons in the Hejaz were having difficulties with the Arabs. A base was established at El Arish, and on 3rd Aug. a well-equipped force of 18,000 advanced to attack Major-General Lawrence's outposts at Romani, in the north of the Sinai Peninsula. The attack was beaten off, and General Sir A. Murray's main body of Australians, New Zealanders, Yeomanry, Territorials, and the 32nd Division coming up,



Map showing the converging lines of the main British advances in Mesopotamia and Palestine at the points reached on 31st Oct., 1918

and 3400 prisoners (28th Sept., 1917). Other successes were gained at Tekrit and the Jebel Hamrin hills before Sir Stanley Maude died of cholera (18th Nov.). He was succeeded by General Marshall, who, in 1918, occupied Hit on the Euphrates, and ended the Mesopotamian campaign with a crushing victory at Mosul just before the Armistice.

#### *Palestine Campaign*

Turkey assumed the offensive against Egypt, of which the Sultans were nominally suzerains, by an attempt to force the Suez Canal in Feb., 1915. A force under Djemal Pasha made a dash across the 150 miles of the Sinai Peninsula from Palestine, and was in a position to attack Ismailia and the Bitter Lakes on 2nd Feb. The ample Imperial troops on the spot enabled General Mar-

counter-attacked and drove the Turks back 18 miles, inflicting a loss of 4000 prisoners and 4 guns. Between the 6th and 12th Aug. General Murray improved on his victory, and advanced steadily to Muzar (16th Sept.) and El Arish, evacuated by the Turks (20th Dec.). On 22nd Dec. an attack was made by one of the desert columns on Magdhaba, and the whole Turkish force of 3000 destroyed or captured.

On 9th Jan., 1917, the columns under Generals Dobell and Chetwode reached Rafa, the Mediterranean port on the southern borders of Palestine. A pipe line conveying water and a railway followed close on General Murray's advance, and by the middle of March, 1917, these had reached Rafa, enabling an advance to be begun in Palestine, with Gaza as the immediate objective. The first battle of Gaza began on 26th March. It was a failure. Chetwode's

mounted forces, including the Australians, moved in a wide detour round Gaza, which was entered while Dobell's infantry attacked the main Turkish positions. But the infantry thrust was not strong enough to penetrate the opposition offered to it, and after two days' fighting the attack was called off. Water was short, and General Murray suspended further attack till 19th April, when, as frequently happened, the Turks, having been reinforced and established in good positions, fought well and beat off the assailants.

Sir A. Murray and General Dobell left the Palestine operations, and General Sir E. Allenby was sent out to organize a subsequent advance when the opportunity was propitious. He was reinforced; the communications were improved through the summer; and on 31st Oct. he surprised the Turks by making a diversion towards Beersheba while demonstrating towards Gaza. Beersheba was rushed by the Australians, and Allenby's right secured. He then sent the 52nd Division to a point between Gaza and the sea while occupying Ali Muntar, and from these two vantage points shelled the Turks out (7th Nov.). It was the decision of the Allied War Council at Versailles in the autumn of 1917 that Allenby, strongly reinforced, should put the Turks out of the war by one decisive blow, since they were already in straits by reason of losses in their numerous campaigns, including those against the Arabs of the Hejaz, which had been organized by the Emir Feisal and Colonel T. E. Lawrence. Accordingly, the Turks were pursued through Ascalon and Ashdod to Jaffa (16th Nov.). Allenby's main column pressed on more slowly between Beersheba and Hebron (7th Dec.), but entered Jerusalem on 9th Dec., after disposing of an ineffective Turkish stand on the day before. The operations were practically suspended after the Jordan had been crossed at the end of March, 1918, when it became necessary to recall some of the best British divisions to France to meet the last German onslaught in France and Flanders.

When this had been disposed of, Allenby, who had been supplied with Indian divisions, and who, in Sept., 1918, was much superior in forces and artillery to the Turks, resumed his attack (19th Sept.). Facing him were the Turkish Seventh and Eighth Armies in front of Shechem, and the Turkish Fourth Army east of Jordan. A heavy artillery preparation ushered in a frontal infantry attack which tore a gap in the Turkish right and right centre, and through it the cavalry swept north across the Plain of Sharon to reach and seize the passes at Megiddo. Another infantry attack pinned the Eighth Army on the Jordan. The Turks began to retreat too late, for the Imperial cavalry, pouring through the

Megiddo passes, crossed the plain of Esdraelon and barred every avenue of retreat on the western side of Jordan. They only missed the capture of General Liman von Sanders at Nazareth by a few hours.

The Turkish armies were in effect destroyed, for on the eastern side of Jordan the Arab cavalry of the Emir Feisal had turned the line of retreat there, and had cut the Hejaz railway running to Damascus. In less than a week the Turkish Seventh and Eighth Armies were wiped out, and 10,000 of the Fourth Army surrendered at Rabboth Amman (29th Sept.). Irbid and Acre on the coast fell as fast as the Imperial cavalry could reach them. Damascus was entered by the Australians on 1st Oct. Beirut fell a few days later, and by the end of October General Allenby had reached Aleppo. The Turkish Cabinet immediately entered into negotiations, Enver Pasha and Talat Pasha having been replaced. An armistice was signed on 30th Oct. at Mudros, and Turkey was out of the war. It may be added that Talat Pasha, who was responsible for the massacres of the Armenians, was killed in Berlin by an Armenian student in 1921.

#### *The War in Germany's Colonies*

Within a few weeks of the outbreak of hostilities the war had been carried to all the scattered possessions of Germany in Africa, the Pacific, and the Far East. Among the first to fall were German Samoa (occupied by the New Zealand troops on 29th Aug.); the islands of the Bismarck Archipelago and German New Guinea (occupied by the Australians on 11th-13th Sept.); and the more northerly islands of the Pacific, surrendered at the beginning of October to a Japanese squadron. These last were at once handed over by Japan to Australia. Japan, faithful to her alliance with Great Britain, had declared war against Germany on 23rd Aug., and attacked the formidable German post of Kiaochow, 'the key to Northern China', which had been seized by Germany on the flimsiest pretext in 1898. Japan invested Kiaochow—garrisoned by 6000 well-armed men, with powerful defences—with a force of 23,000 troops under General Kamio, supported by a small British contingent of South Wales Borderers and Sikhs under General Barnardiston. After a six weeks' siege, and a preliminary bombardment preparatory to launching a final assault, the garrison capitulated (7th Nov.).<sup>1</sup>

The remainder of Germany's colonies were in

<sup>1</sup> Japan afterwards assisted the Allies with war supplies—particularly with heavy guns to Russia before the Bolshevik betrayal—subsequently helping to stem the tide of Bolshevism in the Far East, besides contributing with her ships to the defeat of the German submarine campaign in the Mediterranean.

Africa, where the campaigns resulting in their conquest varied from a few weeks to the whole length of the war. The shortest was in Togoland, which surrendered unconditionally to a Franco-British force under Colonel Bryant on 27th Aug., 1914, after a brisk little campaign lasting just three weeks. The Cameroons, larger than the Fatherland, took much longer to subdue, and the operations were of a more arduous nature. A false start was made from Nigeria with insufficient forces, which met with disaster towards the end of August. A more adequate expedition was then organized under General C. M. Dobell, in co-operation with French forces under General Aymerich. Duala, the capital, was occupied on 27th Sept., but it was only after desultory fighting for a year and a half that the Germans, realizing the hopelessness of further resistance, left the colony to its fate by retreating into the neighbouring Spanish territory of Rio Muni.

The campaign in German South-West Africa was held up at first by the revolt in South Africa, which had to be crushed before General Botha was free to give his undivided attention to the task which he had offered to undertake in proof of the Union's loyalty. A preliminary move had been made in September by the occupation of the coastal harbours, Luderitz Bay and Swakopmund, from which the Germans retired to concentrate in Windhoek, their capital inland. A 'regrettable incident' occurred on 20th Sept., 1914, when a British patrol was attacked at Sandfontein and a small relief force compelled to surrender. This was followed by news of the revolt of Maritz, who had been partly responsible for the reverse at Sandfontein; and the small civil war which followed in South Africa, though nipped in the bud by the sterling loyalty of most South Africans, served to postpone the conquest of German South-West Africa until the following year.

When the campaign began in earnest in the spring of 1915, the whole south-eastern part of the German colony had already been cleared by Colonel van Deventer, whose desert march with three separate columns in these preliminary operations was one of the outstanding achievements of the campaign. In the great converging march which followed, led in the south by General Smuts, and in the north by General Botha, with columns consisting largely of mounted burghers from the Transvaal and Orange Free State, the Germans were out-fought and outmanoeuvred throughout. The advance began on 27th April, and by 5th May Botha, building a light railway with supplies behind him, entered Karibib without opposition, and Windhoek a week later, the Germans, 5000 strong but greatly outnumbered, withdrawing

the bulk of their forces to the north. Twice they proposed an armistice, offering terms, but the only terms that Botha would agree to implied unconditional surrender. Having rested and refitted his men after this trying trek across country from Swakopmund, he proceeded to enforce these terms by a series of remarkable marching feats, with his own columns in the centre and those of Brits and Myburgh to left and right respectively, starting on 18th June. In less than a week Botha's force had covered 100 miles and captured Otiwarango; on 1st July, after a brief rest, his infantry were in touch with the enemy's main force, entrenched from Otavi to Tsuneh, with Brits and Myburgh sweeping round on either side. On 8th July all resistance collapsed with the total surrender of the Germans under Colonel Franks, the military commandant. The whole campaign in South-West Africa did not cost us more than 140 lives, and total casualties amounting to 1200.

The conquest of German East Africa was a very different affair. It was opposed by a force which, at its maximum, could muster 25,000 well-drilled troops—2000 of them Europeans—with 60 guns and machine-guns, and sufficient supplies of ammunition; the whole commanded by von Lettow-Vorbeck, a leader of resource and inflexible determination. When, at the outbreak of war, the British cruisers *Astron* and *Pegasus* bombarded Dar-es-Salaam and destroyed the wireless station, the Germans retaliated by crippling the *Pegasus*, then lying at Mombasa, with their fast cruiser *Königsberg*, which had fled to East Africa after escaping the fate of the rest of von Spee's squadron off the Falkland Islands. They also raided the Uganda railway, occupied Taveta on the British East African border, and threatened an advance on Mombasa along the coast. This was checked by the arrival of British reinforcements, naval and military, the naval units of which forced the *Königsberg* to seek the shelter of the Rufiji River, where, as already stated, she was afterwards destroyed.

A second expeditionary force under General Aitken was brought from India in the closing months of the year, and ordered to land at the northern German port of Tanga, with the object of cutting off the enemy troops operating on the British border. The magnitude of the task had been gravely under-estimated. Landing on 4th Nov. in difficult bush country—familiar enough to the defenders, but an impenetrable maze to the landing force—the attempt ended in disaster, costing some 800 casualties before the expedition re-embarked. Another blow was dealt by von Lettow-Vorbeck early in 1915 (19th Jan.) when he recaptured Jasin, gallantly held to the last by Indian troops under Colonel Ragbir Singh; but in the same month he lost



one of his chief ports on Victoria Nyanza; in the following May other British forces captured Sphinxhaven after an action by armed steamers; and a blockade was declared of the German East African coast, where the Island of Mafia, off the mouth of the Rufiji River, was also seized. Several blockade-runners succeeded in getting

relinquish it through ill-health shortly after landing in Africa. His place was filled by General Smuts, who arrived on the scene in Feb., 1916, and started his campaign in the following month by clearing the enemy from the British borderland and the Kilimanjaro district. Much valuable spade-work had been previously done

in this direction by General Tighe as a preliminary to sweeping the enemy's main forces southwards, while the Belgians from the Belgian Congo cleared his north-western province of Ruanad, and British forces drove his garrisons from the shores of Victoria Nyanza. The first stage in the new campaign was closed when Smuts established his headquarters at Moshi, where he reorganized his force in three divisions, one (British and Indian) under Hoskins, the other two (South African), under van Deventer and Brits. Van Deventer's force had the hardest task in clearing the Germans from Kondoa Irangi on his march to the central railway, von Lettow-Vorbeck making his one great defensive stand in this direction. Van Deventer, however, was too quick for him; beat off his counter-attack after the capture of Kondoa Irangi (10th April, 1916); and struck hard when he attempted to bar the progress of Smuts's other two columns, which, after clearing the Gare and Usambara mountains in May and June, had pushed into the Nguru hills from Kamgata. By this time the Germans realized that they were outmatched both in strategy and numbers, and the bulk



Map illustrating the blockade of the German East African Coast—the shaded area—and the military operations early in 1915

through to von Lettow-Vorbeck with much-needed supplies of ammunition; and with Britain's hands full to overflying with other campaigns, the main German forces in East Africa had perforce to be left until Botha had completed the conquest of South-West Africa, and the Union was free to lend a hand in expelling the Germans from the last and most valuable of their colonies.

When at length the new expeditionary force was nearly ready, the command was given to General Smith-Dorrien, but he was forced to

of them would probably have shortened the war but for von Lettow-Vorbeck, who was determined to hold out, if possible, until the fate of Germany's 'place in the sun' had been decided on the battlefields of Europe. More than once it seemed as though he could not escape the wide net which Smuts flung out to trap him, but he proved as elusive as De Wet in the South African War, usually escaping with his diminishing forces through tracks unknown to his pursuers.

All the railways and ports were lost during the remainder of 1916. Dar-es-Salaam, the capital, surrendering on 8rd Sept. Towards the end of that year the Belgians from the Congo under General Tombeur drove the enemy from Tubora, on the central railway; British troops under General Northey helped in the converging movement from Northern Rhodesia—which had been invaded by the Germans at the beginning of the war—by advancing as far as Iringa. In the extreme south some Portuguese had also joined in the movement by an advance across the Rovuma River, but were forced back by a German column, and punished by raiding parties in their own territory.

The campaign seemed practically over at the beginning of 1917, when General Smuts was summoned to Great Britain to share in an Imperial conference, and General Hoskins was left to account for the remainder of the enemy, now hemmed in on nearly all sides in the south-eastern corner of the colony, with von Lettow-Vorbeck's head-quarters at Mahenge. Torrential rains came to the Germans' rescue, and little progress had been made before Hoskins, called away to another theatre of war, was succeeded by General van Deventer in May (1917). Guerrilla warfare continued throughout the year, in which both sides suffered heavily, but it was not until 1st Dec. that van Deventer could report that the former Germany colony was at length clear of the enemy. Forced out of Mahenge (occupied by the Belgians on 9th Oct.), the Germans retired in two main bodies towards the Portuguese frontier, one under Tafel, which was cut off and compelled to surrender on 26th Nov., and the other under von Lettow-Vorbeck, which contrived to escape across the border and continue the war in Mozambique for nearly another year. Allied columns pursued the remnants unceasingly, but could never get to real grips with them in the difficult bush country between the Rovuma and the Zambesi. Towards the end of September, 1918, von Lettow-Vorbeck dashed back, re-crossed the Rovuma, and coolly marched across the south-western corner of German East Africa into Northern Rhodesia, where he was being finally rounded up when news arrived of the Armistice. It was not, however, until 14th Nov. that the German leader was able to comply with the Armistice terms of unconditional surrender on his part, tendering his submission to the British magistrate at Kasama. In recognition of their "gallant and prolonged resistance", von Lettow-Vorbeck and his officers were permitted by General van Deventer to retain their swords, while the European rank and file were allowed to carry their arms as far as Dar-es-Salaam.

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**Eurotium.** See *Plectasineæ*.

**Eurydice** (ἑυριδίκη), in Greek mythology, the wife of Orpheus (q.v.).

**Eusebius**, of Cæsarea, the father of ecclesiastical history, a Greek writer, born in Palestine about A.D. 205, died about 340. About 315 he was appointed Bishop of Cæsarea. When the Arian controversy broke out, Eusebius showed considerable sympathy with Arius. At the Council of Nicæa (A.D. 325), when Arian doctrines were condemned, he took a leading part. His ecclesiastical history (*Historia Ecclesiastica*) extends from the birth of Christ to 324. Amongst his other extant works is a life of Constantine the Great, which may be said to continue his ecclesiastical history to within a few years of the writer's own death.

**Eusporangiate Ferns**, those in which the sporangium is a massive organ arising from several cells, whereas in leptosporangiate ferns it is a more delicate structure derived from a single superficial cell. The bulk of living ferns are leptosporangiate, the eusporangiate class comprising only two living families, viz. the Marattiaceæ and Ophioglossaceæ, as well as many extinct types. The eusporangiate types include the more primitive ferns; all the other main groups of Pteridophytes, and the seed-plants are also eusporangiate.

**Eustachian Tube**, in anatomy, a canal

leading from the pharynx to the tympanum of the ear.

**Eustachio**, Bartolomeo, Italian physician and anatomist, born soon after 1500, died about 1574. He devoted himself to medical science and in particular to anatomy, which he much enriched by his researches. Amongst his discoveries were the *eustachian tube* and the eustachian valve of the heart.

**Eustatius, St.**, or **St. Eustache Island**, a Dutch island in the W. Indies, one of the Leeward Islands, 11 miles north-west of St. Christopher's, pyramidal in form; area, 8 sq. miles. Sugar, cotton, and maize are raised; but the principal production is tobacco. The climate is healthy, but earthquakes are frequent. Pop. 1431.

**Euter'pe**, (1) one of the Muses, considered as presiding over lyric poetry, the invention of the flute being ascribed to her. She is usually represented as a virgin crowned with flowers, having a flute in her hand. (2) In botany, a genus of palms, natives of South America, sometimes nearly 100 feet in height.

**Euthanasia**, literally, a painless or easy death, a term often used in connection with the theory or proposal that it should be lawful to administer drugs to bring about a painless death, in the case of persons suffering from painful and hopeless diseases.

**Eutro'pius**, Flavius, a Latin historian, who flourished about A.D. 300. His abridgment of the history of Rome (*Breviarium Historiæ Romanæ*) is written in a perspicuous style, and is often read, or rather spelled out word by word, by beginners in Latin. It is of little or no authority as a history.

**Eutyches** (n'ti-kêz), a Greek heresiarch who lived in the fifth century after Christ. He was superior of a monastery near Constantinople, and his heresy consisted in maintaining that after the incarnation there was only a divine nature in Christ under the appearance of a human body. The doctrines of Eutyches were condemned by the Council of Chalcedon in 451, and he was expelled from his monastery. He died not long afterwards. His followers were often called Monophysites (Gr. *monos*, single, *physis*, nature) as well as Eutychians.

**Euxanthine**, a substance supposed to be derived from the bile or urine of the buffalo, camel, or elephant. It comes from India under the name of purree or Indian yellow, and is used as a pigment.

**Eux'ine** (*Pontus Euxinus*), the ancient name for the Black Sea.

**Evangel'ical**, a term often used to qualify certain theological views, especially strict views on the question of the atonement, justification by faith, the inspiration and authority of the

Scriptures, and allied doctrines. In England the so-called Low Church party is evangelical in its views. In a more general sense the word implies a peculiar fervency and earnestness in insisting on such doctrines as regeneration and redemption. The 'Evangelical Church' is the official title of the Established Church of Prussia, formed in 1817 by the union of Lutherans and Calvinists.

**Evangelical Alliance**, an association of members of different sections of the Christian Church, organized in London in 1845, to lend its influence in favour of evangelical doctrines, religious union and liberty, and against superstition and unbelief. The Alliance, incorporated in 1912, has branches throughout the world, the American branch being especially strong, and has held meetings at Paris, Berlin, Amsterdam, Geneva, New York, Copenhagen, Florence, and London. A week of united prayer is held in London in the early part of January each year. The organ of the Alliance, *Evangelical Christendom*, is published in London.

**Evangelical Association**, a body of American Christians, chiefly of German descent, established about the beginning of the last century. In form of government and mode of worship it generally agrees with the Methodist Episcopal Church.

**Evangelical Union**, the name of a religious sect, also familiarly known as the Morisonians, from the Rev. James Morison, its originator. It took rise in Scotland in 1840, and three years afterwards organized itself as a separate Christian denomination. The Morisonians maintain the universality of the atonement, combining with this the doctrine of eternal personal and unconditional election, and denying that anyone will be condemned for Adam's fall. In point of government the individual Churches are independent. The body has now only a few adherents, the majority having united in 1890 with the Congregationalists.

**Evangelists**, the writers of the history or doctrines, precepts, actions, life, and death of Christ; in particular, the *four evangelists*, Matthew, Mark, Luke, and John. The ancient symbols of the four evangelists are: for Matthew, *a man's face*; for Mark, *a lion*; for Luke, *an ox*; and for John, *a flying eagle*.

**Evans**, Sir Arthur John, born in 1851, son of Sir John Evans. He was educated at Harrow, Oxford, and Göttingen, is a distinguished archaeologist, as well as an investigator into the history and affairs of Eastern Europe, and in particular has made important investigations and discoveries in Crete. He has travelled in Finland, Lapland, and the Balkan countries, and has written works connected with these travels and with his archaeological researches. From 1884 to 1908 he was keeper of the Ashmolean Museum, Oxford. He was knighted in 1911,

and was president of the British Association 1910-7. Among his works are: *Through Bosnia*, and *Scripta Minoa*.

Evans, Sir George de Lacy, a British general, born at Moig, in Ireland, in 1787, died 9th Jan., 1870. After some years of service in India, he joined the army of Wellington in the Peninsula in 1812, where he served with distinction. In 1814 he was sent to America, and was present at the battles of Bladensburg and New Orleans, returning to Europe in time to take part in Waterloo. In 1830 and 1831 he was elected member for Rye, and in 1833 for Westminster. In 1835 he was appointed to the command of 10,000 troops raised in Britain on behalf of the Queen of Spain. Under the training of Evans this force became an excellent army, and several times defeated the Carlists. During the Crimean War he distinguished himself as commander of the second division of the English army, and received the thanks of the House and other honours.

Evans, Sir John, English archaeologist, born in 1823, died in 1908, was an active member of a firm of paper-makers, but eventually retired from business and devoted himself chiefly to scientific pursuits, being distinguished as a geologist, numismatist, and antiquarian. From 1878 till 1896 he was treasurer of the Royal Society; in 1897 he was president at the Toronto meeting of the British Association. He was created a K.C.B. in 1892. His chief works are: *The Ancient Stone Implements, Weapons, and Ornaments of Great Britain and Ireland*; and *The Ancient Bronze Implements, Weapons, and Ornaments of Great Britain and Ireland*.

Ev'anston, a city of the United States, Illinois, 13 miles from Chicago. It is pleasantly situated on Lake Michigan. It is the seat of the North-Western University and other institutions. Pop. 37,215.

Ev'ansville, a town in the United States, in Indiana, pleasantly situated on a height above the Ohio. It contains some handsome buildings, including custom-house and post office. Coal and iron abound in the vicinity, and there are numerous factories, flour-mills, and iron-foundries, and a large shipping trade. Pop. 85,264.

Evaporation, the process of changing a liquid into vapour, which goes on at the surface of the liquid. When evaporation takes place into a closed space above the liquid, a state is reached in which the space is saturated with vapour, and no further change is apparent. Certain conditions influence the rate at which evaporation takes place in the open, such as the extent of the exposed surface, the dryness, pressure, and temperature of the air, and the presence or absence of wind. The farmer looks for a drying wind to dry his corn-sheaves before

they are carted from the field. Evaporation is always accompanied by an absorption of heat by the vapour, namely the latent heat necessary for the change of state from liquid to vapour. This heat is abstracted from the liquid, which, as a consequence, falls in temperature, and neighbouring bodies may also be cooled. A bather emerging from the water experiences this cooling as the water evaporates from his skin. In hot countries, water is kept cool by being placed in porous earthenware jars: the evaporation which takes place at the outer surface prevents the water in the jar from becoming too warm. The continual evaporation from land and water surfaces is the cause of the presence of water in the atmosphere, whether in the form of invisible vapour or of cloud, mist, fog, rain, hail, or snow. The cooling caused by evaporation is applied in industry in the case of the ammonia compression machine, in working refrigerating plant for the preservation of food-stuffs, and in the manufacture of artificial ice. When evaporation takes place at the surface of a dry solid, the process is called sublimation, and it may be observed in the cases of iodine, camphor, and ice.

Ev'elyn, John, an English writer of the seventeenth century, born at Wotton, in Surrey, 31st Oct., 1620, died there, 27th Feb., 1700. After completing his course at Oxford, he studied law at the Middle Temple, visited various parts of the Continent, and in 1659 prepared the way for the Restoration. He published numerous works, amongst which are: *Sculptura, or the History and Art of Chalcography*; *Sylva, or a Discourse of Forest Trees*; treatises on gardening and architecture. But by far his most important work is his memoirs, comprehending a diary and correspondence, which are interesting contributions to the history of the time. Evelyn's *Diary* was first published in 1818, and an edition by Austin Dobson appeared in 1906.—Cf. H. Maynard Smith, *The Early Life of John Evelyn*.

Evening-primrose, *Oenothera*, a genus of plants, nat. ord. Onagraceae. *O. biennis*, an American species common in cottage gardens, is not infrequent as an escaped plant in England.

Ev'erst, Mount, the highest summit of the Himalaya and the loftiest mountain in the world, 29,002 feet. It was named after Sir George Everest (1790-1860), chief of the great Indian trigonometrical survey and Surveyor-General of India. In 1921 an expedition attempted to climb the mountain. See *Mount Everest Expedition*.

Ev'erett, Alexander Hill, an American diplomatist, born at Boston in 1792, died at Canton in 1847. After studying at Harvard, in 1809 he accompanied John Quincy Adams to St. Petersburg (Petrograd) as Secretary of Legation. He afterwards filled successive diplomatic posts in

the Netherlands, Spain, and elsewhere. He was the author, amongst other works, of *Europe, or a General Survey of the Present Situation of the Principal Powers* (1822); and a similar work on America.

Everett, Edward, an American statesman and author, brother of the preceding, born at Dorchester, Massachusetts, 11th April, 1794, died at Boston, 15th Jan., 1865. After travelling for some years in Germany and England, he returned to America in 1819 to occupy the chair of Greek literature at Harvard. He became editor of the *North American Review*, and entering the political world became successively member of Congress, Governor of Massachusetts, and Minister Plenipotentiary in England (1841-5). In 1845 he was appointed president of Harvard College; in 1852 Secretary of State; in 1853 a Senator. He wrote poems; a *Defence of Christianity*; and his speeches and orations have been published.

Evergreen, a plant that retains its verdure through all the seasons, as the fir, the holly, the laurel, the cedar, the cypress, the juniper, the holm-oak, and many others. Evergreens shed their old leaves in the spring or summer, after the new foliage has been formed, and conse-



Everlasting Flower (*Helichrysum acaule*)

quently are verdant through all the winter season. They form a considerable part of the shrubs commonly cultivated in gardens, and are beautiful at all seasons of the year.

Everlasting-flowers, a name applied to certain plants which, when dried, suffer little change

in their appearance. The plants to which this name is peculiarly applied belong to the genus *Helichrysum*, but it is also given to members of allied genera, such as *Antennaria* or *Gnaphalium*.

Everlasting-pea, a popular name for *Lathyrus latifolius*, cultivated in flower-gardens, and belonging to the same genus as the sweet-pea.

Eversion of the Eyelids (Ectropion), is a turning outward of the eyelids, and it may be congenital or acquired. The latter follows severe infection of the hair-follicles of the eyelashes.

Evesham (ēvz'ham), a town in England, in the county and 15 miles S.E. of Worcester, beautifully situated on the Avon, and giving name to a parliamentary division of the county. It was the seat of a monastery as early as the eighth century. Simon de Montfort was defeated by the Royal troops at Evesham on 4th Aug., 1265. Pop. 8685.

Eviction, the dispossession of a person from the occupancy of lands or tenements. The term occurs most commonly in connection with the proceedings by which a landlord ejects his tenant for non-payment of rent or on determination of the tenancy. In the case of eviction of tenants in Ireland, generally for non-payment of rent, the tenants are frequently readmitted as caretakers, or under some other title. The Rent Restrictions Act, 1920, operative until 1923, severely curtails a landlord's common law rights to recover possession of certain premises at the time when, but for the Act, the tenancy would expire.

Evidence is that which makes evident, which enables the mind to see truth. It may be (a) *intuitive*, i.e. resting on the direct testimony of consciousness, of perception or memory, or on fundamental principles of the human intellect, or it may be (b) *demonstrative*, i.e. in a strict sense, proofs which establish with certainty as in mathematical science certain conclusions; or it may be (c) *probable*, under which class are ranked *moral evidence*, *legal evidence*, and generally every kind of evidence which, though it may be sufficient to satisfy the mind, is not an absolutely certain and incontrovertible demonstration.

In jurisprudence evidence is classified into that which is *direct* and *positive* and that which is *presumptive* and *circumstantial*. The former is that which is proved by some writing containing a positive statement of the facts and binding the party whom it affects; or that which is proved by some witness, who has, and avers himself to have, positive knowledge thereof by means of his senses. Whenever the fact is not so directly and positively established, but is deduced from other facts in evidence, it is *presumptive* and *circumstantial* only. The following are the leading rules regarding evidence in a court of law:

(1) The point in issue is to be proved by the party who asserts the affirmative. But where one person charges another with a culpable omission this rule will not apply, the person who makes the charge being bound to prove it. (2) The best evidence must be given of which the nature of the thing is capable. (3) Hearsay evidence of a fact is not admissible. The principal exceptions to this rule are—death-bed declarations, evidence in questions of pedigree, public right, custom boundaries, declarations against interest, declarations which accompany the facts or are part of the *res gestæ*, &c. (4) Insane persons and idiots are incompetent to be witnesses. But persons temporarily insane are in their lucid intervals received as witnesses. Children are admissible as witnesses as soon as they have a competent share of understanding and know and feel the nature of an oath and of the obligation to speak the truth. BIBLIOGRAPHY: Sir J. F. Stephen, *Digest of the Law of Evidence*; W. M. Best, *Law of Evidence*.

**Evidences of Christianity.** These may be divided broadly into two great classes, viz. *external evidences*, or the body of historical testimonies to the Christian revelation; and *internal evidences*, or arguments drawn from the nature of Christianity itself as exhibited in its teachings and effects, in favour of its divine origin. The first Christian apologies—those of Justin Martyr, Minucius Felix, and Tertullian, written in the second century—were mainly intended as justifications of the Christian religion against the charges of atheism and immorality commonly made at that time. Of a more philosophical kind, and dealing more comprehensively with the principles of religion and belief in general, are the works of Origen, Arnobius, and Augustine in the centuries immediately succeeding. During the Middle Ages, the scientific representation of Christianity is mostly the work of the schoolmen occupied in welding Aristotelian or Platonic philosophy with the fabric of Christian dogmatics, or writing attacks on the Jewish and Mohammedan faiths.

In the sixteenth and seventeenth centuries the influence of the Renaissance and the Reformation gave rise to a spirit of inquiry and criticism which developed English deism as represented by Herbert and Hobbes in the seventeenth century, and Collins and Bolingbroke in the eighteenth. The general position of English deism was the acceptance of the belief in the existence of God, and the profession of natural religion along with opposition to the mysteries and special claims of Christianity. It was in confutation of this position that the great English works on the evidences of Christianity of Butler, Berkeley, and Cudworth were written. In France the new spirit of inquiry was represented by Diderot,

D'Holbach, and the encyclopedists in general, who assailed Christianity mainly on the ground that it was founded on imposture and superstition, and maintained by sacerdotal trickery and hypocrisy. No reply of any great value was produced in the French Church, although in the previous age Pascal in his *Pensées* had brought together some of the profoundest considerations yet offered in favour of revealed religion. The nineteenth century has been distinguished by the strongly rationalistic spirit of its criticism. The works of such writers as Strauss, Bauer, and Feuerbach, attempting to eliminate the supernatural and the mysterious in the origin of Christianity, have been answered by the works of Neander, Ebrard, and Ullmann on the other side. The historical method of investigation, represented alike by the Hegelian school and the Positivists and Agnostics in philosophy, and by the Revolutionists in science, is the basis of the chief attacks of the present time against the supernatural character of Christianity. The tendency of all the critics is to hold that while Christianity is the highest and most perfect development to which the religious spirit has yet attained, it differs simply in degree of development from any other religion. Notable amongst later apologists of Christianity have been Paley (*Natural Theology*), Chalmers (*Natural Theology*), Mansel, Liddon, and others.—BIBLIOGRAPHY: J. R. Illingworth, *Reason and Revelation*; A. Garvie, *Handbook of Christian Apologetics*.

**Evil, Origin of.** The difficulty of the question lies mainly in this, that the existence of evil in the world seems inconsistent with the view that it was created and is maintained by an omnipotent and beneficent creator. The various theories on the subject have all sought to elude this difficulty either by the supposition of some principle of evil equally eternal with that of good, or by regarding evil as having only a relative existence, being a kind of good in an imperfect and immature stage. Perhaps the oldest theory upon this subject is that of Parsicism, or the religion of Zoroaster, according to which there were two original principles, one good (Ormuzd) and the other evil (Ahriman). This is the doctrine that is now very often spoken of as Manichæism, from the fact that it was adopted by Manes, who attempted to engraft it on the doctrines of Christianity. In contradistinction to this dualistic theory with reference to the origin of evil stand the Monistic theories of Brahmanism and Platonism. According to the Brahmanic doctrine of the emanation of all things from one original being (Brahma), this original being was regarded as the sole true existence, and the phenomenal world, with all the evils appearing in it, was held to be mere illusion. Similarly, Plato held that the good was the

essence of all things, and that the evil and imperfect contained in them had no real existence. The theory enunciated by Leibnitz in his *Theodicee* resembles that of Plato. In that work he assigns to the evil existing in the world created by God, which he holds to be the best of all possible worlds, a merely relative existence. According to Plato, all that we call evil is only evil to us because we do not see it in relation to the rest of the universe, for in relation to the universe it is not evil but good, and accordingly cannot be evil in its own nature. Another view on the subject is that which neither assigns to the evil principle (as it does to God or the good principle) an original existence, nor denies the real existence of evil, but ascribes it to the exercise of man's free-will. Besides the theoretical problem of the origin of evil, there is the practical one of the elimination of evil which forms the subject of *Ethics*.—BIBLIOGRAPHY: H. Rashdall, *The Theory of Good and Evil*; H. Bosanquet, *The Value and Destiny of the Individual*.

**Evil Eye**, a power which, according to an old and widespread superstition, resides in some people of doing injury to others by a mere look, or a look accompanied by certain words or charms. This belief, common amongst the ancients, is still prevalent among the more ignorant classes in Italy, Russia, Andalusia, the Highlands of Scotland, and other places. The Finns, Lapps, and Scandinavians, the Arabs and the Turks are all firm believers in the evil eye.

**Evolute**. The evolute of a curve is the curve which is the envelope of all its normals or the locus of all its centres of curvature. The first curve is called the involute of the second. These names are given to the curves because the end of a stretched thread unwound from the evolute will describe the involute.

**Evolution**, a term introduced into biological writings in the early part of the eighteenth century to denote the mode of generation of living things. At first it was used in the same sense as we now apply the word development, more especially with reference to the process whereby the germ of an animal or plant becomes transformed into the adult organism; but it is now used in biology for the process by which more complex plants or animals have been derived from a series of less specialized ancestors by transformation. In accordance with the teaching of modern biology, all living creatures are the progeny of one original group of microscopic unicellular organisms, different branches of which during many millions of years have become diversely modified in structure and function to form the vast multitudes of diverse species of plants and animals with which we are acquainted.

The idea of a transformation of one type of being into another is extremely ancient, and its origin was in all probability genetically related to the primitive conceptions which have survived to the present day in totemism (q.v.) and such myths as the story of the werewolf. For once it was believed that a totem-animal, like a cow or a pig, could give birth to human beings, or that the Great Mother could at will assume a great variety of living forms, ranging from a mollusc or a grain of barley to a higher mammal, it was a comparatively simple step to arrange these potential 'ancestors' in a series, and provide mankind with a mythical genealogy. It is possible that such beliefs may have suggested to the Greek philosophers, such as Aristotle, speculations as to the process by which custom and change of habit might modify the structure of animals. But it was not until the end of the seventeenth century that the trend of philosophical speculation, associated with the growing understanding of natural processes, started lines of investigation which, after many failures, eventually brought forth Charles Darwin's *Origin of Species* in 1859, and established once for all the fact that different species of animals and plants have been produced by the differentiation of the progeny of the same ultimate ancestors. The history of these events was admirably summarized by Huxley in 1878 in an article *Evolution in Biology*, republished in *Darwiniana* (1893, p. 187); in this account due credit is given to the pioneers of the eighteenth and early nineteenth centuries, such as Lamarck, and to Darwin's co-discoverer of the hypothesis of natural selection, Alfred Russel Wallace.

At the present time there is a general consensus of opinion among serious biologists, and, in fact, most educated men, as to the reality of evolution; but there is wide divergence of opinion as to the exact pedigrees of the various groups of plants and animals, and especially as to the mechanisms whereby the processes of transformation have been effected.

The evidence that establishes the proof of evolution is of manifold kinds. "The gradations of structure, from extreme simplicity to very great complexity, presented by living things, and of the relation of these graduated forms to one another. The existence of an analogy between the series of gradations presented by the species which compose any great group of animals or plants, and the species of embryonic conditions of the highest members of that group. Large groups of species of widely different habits present the same fundamental plan of structure; and parts of the same animal or plant, the functions of which are very different, likewise exhibit modifications of a common plan. Structures are found in a rudimentary or apparently



useless condition in one species of a group which are fully developed and have definite functions in other species of the same group. These considerations, when studied in conjunction with the facts of the geological succession of the forms of life, of geographical distribution, and the effects of varying conditions upon living organisms, establish the truth of evolution" (Huxley).

The full meaning of these statements will be better understood if a concrete example is studied, and perhaps the case of man and his ancestry is most instructive for this purpose. The fact that man has a vertebral column, a brain and nervous system, a heart and blood-vessels, digestive and other systems of organs, built up in accordance with the arbitrary plan which is shared also by all mammals, birds, reptiles, amphibians, and fishes, proclaims that man belongs to the vertebrate group of animals, and that all such vertebrates must originally have sprung from the same common ancestors. The possession of four limbs with five fingers or toes on each, and a host of identical arrangements of bones, muscles, nerves, &c., in these limbs, reveals the fact that all the four-limbed creatures or Tetrapoda represent one group which developed from some fish-like ancestor to become an amphibian. The discovery of fossilized remains of extinct animals reveals that the fishes are much older than the amphibians, and that a number of intermediate stages demonstrate the process of gradual transformation which converted one group of fishes into four-limbed, semi-terrestrial amphibians. Geological evidence also proves that the reptiles came definitely later than the amphibians, and that only one small group of very primitive amphibians shared in the progressive modifications of brain, limbs, and organs of circulation, &c., to become reptiles—creatures able to live wholly on the dry land, and capable of a wider range of activities than the Amphibia. From the primitive reptiles were derived not only the highly specialized forms that have survived to the present day as lizards, tortoises, snakes, &c., creatures that differ profoundly from their earliest reptilian ancestors, but also the ancestors of birds and the ancestors of mammals. One particular group of primitive reptiles is known, from fossilized remains found in South Africa, that reveals many of the distinctive peculiarities of mammals not shared by other reptiles; and it is now certain that these cynodonts—so called from their dog-like teeth—include the parents of the mammals. The fact that all the Mammalia are provided with glands which in the female supply milk for the nutrition of their young, that they have a hairy coat, that they have a highly developed brain more fully adapted for

learning by experience than is the case in other vertebrates, that they have limbs capable of a much more varied and active range of skilled movements, and a host of identical transformations of viscera, muscles, nerves, and vessels, prove the common ancestry of mammals from some very primitive cynodont reptile. Different mammals have been specialized in structure for amazingly varied modes of life, on land, under the ground, in trees, in the air, or in rivers or the sea. Of the terrestrial animals some have been modified for fleetness, like the horse and the antelope; others for strength, like the elephant; others again, like the lion and the tiger, to prey upon their weaker relatives. At the dawn of the age of mammals one particular group was able to survive without any of the profound alterations of the structure of the limbs which such creatures as the horse and the ox, the elephant and the whale, the tiger and the bat had to adopt to avoid extinction, and retained the primitive type of limbs with their fingers and toes which became the most useful and plastic instruments for performing skilled movements and acquiring experience and knowledge as soon as the brain was sufficiently advanced in structure and capability to put these instruments to their full use. The group of mammals which delayed the time of specialization until it was able to profit by its greater adaptability was the Prosimia, the ancestors of the apes and man. These small creatures for a long time lived a life of obscurity in trees without submitting to those extreme adaptations of structure which are found in most arboreal and flying mammals. But the cultivation of their powers of vision, and the acquisition of skill in the use of their primitive but plastic hands, guided by vision, eventually conferred upon some of these Prosimia vastly enhanced powers of skilled action and of learning by experience and of acquiring knowledge, which culminated in the attainment of the supreme power of discrimination distinctive of human intelligence.

The fact that man belongs to the same order (Primates) as the apes is proved not merely by the possession of a body which in most respects is identical in structure with such of them as the gorilla and the chimpanzee, of a similar process of development characterized by identical stages up to a certain stage, but also by the fact that the blood of man and the apes react towards one another as those of relatives, and in a way not shared by the blood-reactions of other mammals. The apes, also, are subject to certain human diseases from which other mammals are immune. Man shares with the anthropoid apes (gorillas, chimpanzees, orangs, and gibbons) so many peculiarities which differentiate all of them from the tailed monkeys that there can

be no doubt that the human family was derived from a primitive anthropoid ape, possibly a species that lived in the foothills of the Himalayas in Miocene times, as is suggested by fossils recently discovered by Dr. Pilgrim, director of the Geological Survey of India.

The vestigial remains of the muscles, blood-vessels, &c., of the tail reveal the fact that man's Primate ancestry began with a tailed form. In fact, the human embryo actually possesses a tail for some weeks of its existence. If India reveals the fossilized remains of a variety of Miocene anthropoid apes closely akin to the ancestors of man, the gorilla, the chimpanzee, and the orang, the Egyptian Fayum has provided the evidence of the origin of the anthropoid apes in Oligocene times as very diminutive creatures distantly akin to the gibbons, but bearing very obvious indications in the form of their teeth of an affinity with the Prosimian sub-order Tarsiodea, a very interesting group of Eocene Primates found in a fossilized condition in North America and France, one of the members of which has survived in the peculiar Spectral Tarsier still found living in the forests of Borneo, Java, and the Philippines. The detailed study of the structure and development of *Tarsius*, and comparisons with other Primates and mammals of other orders, provide the information necessary to fill in the gaps left in the geological record, and enable us to sketch out the general scheme of man's ancestry, and to appreciate the nature of the factors which determined the evolution of such an intelligent mammal as man.

Within recent years the increasing knowledge of embryology and comparative anatomy, and the recovery of fossilized remains of vast numbers of hitherto unknown animals, has established the truth of evolution and the exact line of ancestry of many animals. Professor Osborn's work on the evolution of the horse, and Dr. C. W. Andrews's revelation of the ancestry of the elephant, are striking recent illustrations of the exactness of the demonstration palæontology can give of the past history of mammals. Dr. Robert Brown and Professor D. M. S. Watson have given conclusive proofs of the origin of mammals and birds from primitive reptiles, and the latter zoologist has pushed back the ancestry of these higher vertebrates still further, and shown how the reptiles were derived from primitive Amphibia, and the changes that occurred in vertebrate anatomy when certain fishes crawled out of the water and developed into four-footed Amphibia. All of these conclusions are matters of fact and not of theory, even if we are still in the dark as to the exact mechanism whereby the variations which the forces of evolution use in effecting transformations were themselves brought about. Within recent years there has

been a revival of interest in the problem whether characters acquired by parents as the result of their individual experience can be transmitted to their offspring. For the last thirty years biologists have been influenced by the teaching of Weismann that nothing happening to the parents can affect the morphological capabilities of the germ plasma from which the next generation is derived; but recent research suggests that this negative doctrine is too rigid, and makes it probable that certain influences brought to bear upon the parents may be transmitted also to the offspring. If this is so, it opens one avenue of explanation of how structural modifications are effected and the possibility of evolution is created. But at the present moment the whole question is being actively investigated and discussed.

Just as every complex animal can be shown to be derived during development from a simple microscopic cell or egg, so the study of evolution reveals the fact that all animals were originally derived from microscopic unicellular animals known as protozoa, which are with difficulty distinguishable from unicellular plants, from which all the varied forms of complex vegetable life were derived. It is equally certain that these unicellular plants and animals are themselves only the specialized descendants of common ancestors — unspecialized unicellular organisms which are neither strictly vegetable nor animal. But we are quite in the dark as to the processes whereby these most primitive living organisms were evolved from inorganic matter, and how they acquired these peculiar properties of growth and differentiation and their powers of reproduction, commonly called vital, which are their distinctive characteristics. Bibliographical references to most of the matters mentioned in this article will be found in the Presidential Address to Section H of the British Association for the Advancement of Science, Dundee meeting (see Report of British Association, 1912).

Ev'ora, a town in Portugal, capital of the province of Alentejo, 75 miles east of Lisbon. It is an ancient place, poorly built, and its walls, citadel, and forts are all in a state of ruin. It has a Roman aqueduct still serviceable, a Gothic cathedral, and an ecclesiastical seminary. Pop. 17,900. The district of Evora has a pop. of 144,300.

Evremond, or Evremont. See *St. Evremond*.

Evreux (ev-reu), a town of N.W. France, capital of the department of Eure, in a fertile valley on the Iton. It is an ancient town with narrow streets and has many fine buildings, including an ancient Gothic cathedral. The town was frequently occupied by the English in the fifteenth century. Pop. 18,950.

Ewald (ä'vält), Georg Heinrich August von, a German Orientalist and Biblical critic, born at Göttingen 16th Nov., 1808, died there 5th May, 1875. After studying at the university of his native town, in 1827 he became extraordinary, in 1831 ordinary professor of theology, and in 1835 professor of Oriental languages. In 1837 he lost his chair at Göttingen on account of his protest against the king's abrogation of the liberal constitution, became professor of theology at Tübingen, but in 1848 returned to his old chair at Göttingen. When Hanover was annexed by Prussia in 1866 he became a zealous defender of the rights of the ex-king. Among his chief works are the following: *Complete Course of the Hebrew Language*, *The Poetical Books of the Old Testament*, *History of the People of Israel*, *Antiquities of the People of Israel*. The *History* is considered his greatest work.

Ewald (ä'vält), Johannes, Danish poet, born at Copenhagen in 1743, died in 1781. After studying theology at Copenhagen University he ran away and enlisted in the Prussian service, which he soon deserted for the Austrian. On his return to Copenhagen an elegy which he wrote on the death of Frederick V of Denmark was received with general admiration, and awoke in himself the consciousness of poetic talent. His reputation rapidly increased with the publication of his tragedies, *The Death of Balder* (English translation by George Borrow), *Adam and Eve*, and *Rolf Krage*; and his odes and songs, notable amongst which are: *King Christian* and *Liden Guever*. Ewald, who had dissipated habits, died in utter poverty. His collected works were published in 1914.

Ewart, James Cossar, zoologist, was born at Penicuik, Midlothian, in 1851, studied medicine at Edinburgh University, graduated in 1874, and was soon after appointed demonstrator of anatomy in the university. From 1875 to 1878 he was Conservator of the museums of University College, London, in the latter year took his M.D. degree, and from 1878 to 1882 was professor of natural history in Aberdeen University, being then appointed to the natural history chair at Edinburgh. Since then (having been also connected with the Scottish Fishery Board for about ten years) he has devoted much attention to the question of fish-culture and preservation, and has visited North America, Denmark, and Norway for purposes of investigation. He has also carried out experiments in the hybridization of zebras and horses. His publications include: *The Locomotor System of the Echinoderms* (with G. J. Romanes, 1881); *The Natural and Artificial Fertilization of Herring Ova* (1884); *On Whitebait* (1886); *On the Preservation of Fish* (1887); *The Electric Organ of the Skate* (1888-9); *The Cranial Nerves and Lateral Sense-organs of the Elasmobranchs* (1889-91); *The Development of the Limbs of the Horse* (1894); *The Peniculi Experiments* (1899); *Guide to Zebras, Hybrids, &c.* (1900); *Multiple Origin of Horses and Ponies* (1904).

*Exalbuminous Seeds*, those which, when ripe, contain no endosperm, this having been entirely absorbed into itself by the developing embryo. Opposed to albuminous seeds. See *Cotyledons*.

*Examiner of Plays*, a British official and censor of plays, who acts for the Lord Chamberlain, under whose jurisdiction the theatres are placed. No play can be produced without the sanction of the examiner, to whom a copy of every new play intended for production must be sent seven clear days before the first performance. The examiner either grants or refuses his licence, and frequently insists upon an alteration of the text. The abolition of this censorship of plays is a subject which in recent years has given rise to much discussion in the theatre-loving world.

*Exanthemata* (eruption of the skin), a term applied to infectious diseases with skin eruptions, accompanied by general disturbances. The term includes scarlet fever, measles, German measles, smallpox, chicken-pox, and others.

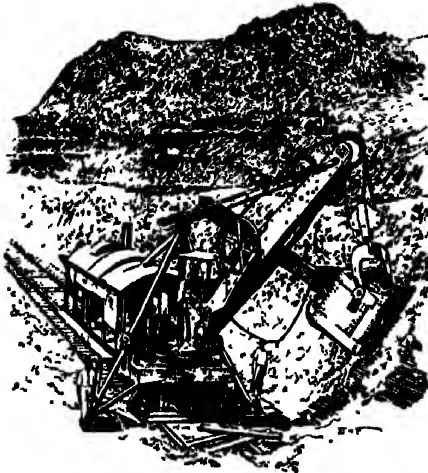
*Exarchate* (egz-är'kät), a name of a province or territory under an *exarch*, or viceroy. In the sixth century after Christ Justinian formed the middle part of Italy into a province of the Eastern Empire, and gave the government of it to an *exarch*. (See *Ravenna*.) *Exarch* was also the title of an ecclesiastical grade in the Greek Church, inferior to the patriarchs but superior to the metropolitans. Among the modern Greeks an *exarch* is a deputy of the patriarch, who travels about in the provinces and visits the bishops and churches.

*Excambion*, in Scots law, the name given to the contract by which one piece of land is exchanged for another.

*Excavation*, the process of removing soil or rock in engineering or exploration works, such as for docks, retaining-walls, railway cuttings, canals, foundations, &c. On a small scale, or in situations unsuitable for machinery, it is performed by hand, the soil being first loosened by the pick, and then shovelled into barrows. In rocky soils, drilling and explosives may be employed. In large works power shovels or 'steam-navvies' are employed, which are essentially cranes carrying a large shovel, or a system of steel buckets of the dredger type. These carry their own means of propulsion, and run on temporary rails laid down as the work proceeds. They work against the face of the excavation, and load directly into bogies or wagons.

*Excavations*. The forgotten history of the remote past has been reconstructed by those

scientists who have explored the sites of ancient seats of civilization. Egyptian and Babylonian-Assyrian investigations date from the middle of the eighteenth century, but it was not until the middle of the nineteenth century, when modern scholars first penetrated the secrets of the lost languages (see *Cuneiform Writing* and *Hieroglyphics*) that the ancient civilizations were rendered more or less articulate. As the texts were being deciphered with increasing ease and accuracy, a basis was provided for archaeology, and it became possible to frame chronological systems. During the latter years of the nineteenth and the early years of the present century, excavators, philologists, and ethnologists



Excavating the Culebra Cut, Panama Canal

have provided a fairly continuous and detailed history of man from 3000 B.C. till classical times, thus bridging a gulf which used to be misty with doubtful legends and traditions. The most dramatic excavations were those begun by Heinrich Schliemann in 1871 at Hisarlik, the site of ancient Troy. On the hillock he dug through nine successive settlements. He afterwards excavated at Mycenæ and Tiryns in Greece and found evidence of a high pre-Hellenic culture. Following up the clues thus afforded, Sir Arthur Evans and others, excavating in Crete during the opening years of the present century, discovered abundant relics, including palaces and towns, of the earliest *Minoan* civilization now referred to as Minoan (see *Crete*). Of late years Central and Western Europe have yielded evidence of the 'drift' of Minoan culture to outlying parts. Excavations in Russian Turkestan and Chinese Turkestan have revealed traces of ancient culture centres dating back beyond 2000 B.C. In the Americas the excavators have thrown

considerable light on the pre-Columbian civilizations of Peru, Central America (Maya), and Mexico, but the picture-writings have not been deciphered. See *Babylonia*; *Crete*; *Egypt*; *Troy*.

**Ex'cellency**, a title given to ambassadors and plenipotentiaries, governors of colonies, the President of the United States, of France, &c.

**Excess Profits Duty**, devised in 1915 to meet the extraordinary expenditure occasioned by the war, is a tax upon the profits of certain trades and businesses carried on in the United Kingdom, or owned or carried on abroad by persons resident in the United Kingdom, in so far as these profits, after deduction of a specified allowance, exceed a pre-war standard. The main exceptions are agriculture, offices and employments, and professions where personal qualifications predominate and only small capital is necessary. In some cases, e.g. estate agencies, where a portion of the profits arises from professional skill, only the portion otherwise arising falls into charge. The pre-war standard is an alternative one at the option of the taxpayer. Firstly, it may be a profits standard—the average of the profits of any two of the last three pre-war years, or if there have been only two pre-war years, then the average profits of those years, or the actual profits of the last year, or if there has been only one pre-war year, then the actual profits of that year. Where the average profits of the last three pre-war years are 25 per cent less than the average of the three years immediately preceding them, the taxpayer may take the average of any four of those six years. Secondly, it may be, and as a general rule where the business has not had one full pre-war year must be, a percentage standard, calculated at the appropriate rate on the capital in the business at the end of the last pre-war trade year, or where there has not been one pre-war year, then on the average amount of capital employed (a) during the year or accounting period in question, or (b) in respect of periods ending after 31st Dec., 1919, during the first accounting period. The percentage standard of sole traders, partnerships, and private companies may in respect of accounting periods ending after that date be increased by £500 per annum for each working proprietor, but not so as to exceed £750 per annum each. The general free allowance is £200, increased in 1920 to £500 for new or re-opened businesses of ex-service men. A further abatement is now granted where profits do not exceed £4000, with the result that liability cannot arise unless profits exceed £832.

The rate of duty, at first 50 per cent, was raised to 60 per cent in 1916, and to 80 per cent in 1917. Reduced to 40 per cent in 1919, it was again increased to 60 per cent by the Finance Act, 1920. It was abolished in 1921. Undoubtedly

it was injurious to trade and an incentive to wasteful expenditure, but an effective substitute for supplying the unparalleled financial needs of the State resulting from the war apparently could not be devised.

'Munitions Levy' is the counterpart of Excess Profits Duty in its application to Government-controlled establishments for the production of munitions of war.

In the fiscal year 1919-20 the tax produced £290,045,000, while the estimate for the year 1920-1 was £220,000,000.

**Exchange**, a place in large commercial towns where merchants, agents, bankers, brokers, and others concerned in commercial affairs meet at certain times for the transaction of business. The institution of exchanges dates from the sixteenth century. They originated in the important trading cities of Italy, Germany, and the Netherlands, from which last-named country they were introduced into England. The Royal Exchange of London was established by Sir Thomas Gresham in 1556. In some exchanges only a special class of business is transacted. Thus there are stock exchanges, corn exchanges, coal exchanges, cotton exchanges.

**Exchange**, in commerce, that species of transactions by which the debts of individuals residing at a distance are cancelled by order, draft, or bill of exchange, without the transmission of specie. Thus, a merchant in London who owes £100 worth of cotton goods in Glasgow gives a bill or order for that amount which can be negotiated through banking agencies or otherwise against similar debts owing by other parties in Glasgow who have payments to make in London. The creditor in Glasgow is thus paid by the debtor in London, and this contrivance obviates the expense and risk of transmitting money. The process of liquidating obligations between different nations is carried on in the same way by an exchange of foreign bills. When all the accounts of one country correspond in value with those of another, so that there is an even balance, the exchange between the countries will be *at par*, that is, the sum for which the bill is drawn in the one country will be the exact value of it in the other. Exchange is said to be *at par* when, for instance, a bill drawn in New York for the payment of \$100 sterling in London can be purchased there for \$100. If it can be purchased for less, exchange is *under par* and is against London. If the purchaser is obliged to give more, exchange is *above par* and in favour of London. Although the numerous circumstances which incessantly affect the state of debt and credit prevent the ordinary course of exchange from being almost ever precisely at par, its fluctuations are confined within narrow limits, and if direct exchange is unfavourable

between two countries this can often be obviated by the interposition of bills drawn on other countries where an opposite state of matters prevails. See *Bill of Exchange*.—BIBLIOGRAPHY: G. J. Goschen, *Theory of Foreign Exchange*; H. Withers, *Money Changing*.

**Exchange, Deed of**, in English law, an original common law conveyance for the mutual transfer of real estate. It takes place between two contracting parties only, although several individuals may be included in each party; and the parties must take an equal estate, as fee-simple for fee-simple, legal estate for legal estate, copyhold for copyhold of the same manor, and the like.

**Exchequer** (Fr. *échiquier*, chess-board), in Britain, the department which deals with the moneys received and paid on behalf of the public services of the country. The public revenues are paid into the Bank of England (or of Ireland) to account of the Exchequer, and these receipts as well as the necessary payments for the public service are under the supervision of an important official called the Comptroller and Auditor General, the payments being granted by him on receipt of the proper orders proceeding through the Treasury. The public accounts are also audited in his department. The Chancellor of the Exchequer, who must be a member of the House of Commons, is the head of the Treasury Department. When the Prime Minister is a member of the House of Commons, he sometimes holds the office of Chancellor of the Exchequer.

**Exchequer, Court of**, an ancient English court of record, established by William the Conqueror, and intended principally for the care and collection of the royal revenues. It was one of the supreme courts of common law, and is said to derive its name from the chequered cloth, resembling a chess-board, on which the sums were marked and scored with counters. The judges of this court were the chief baron and five junior or *puisné* barons. This court was abolished by the Judicature Act of 1873, and its jurisdiction transferred to the High Court of Justice. In Canada there is a Court of Exchequer for the Dominion.

**Exchequer and Audit Department**, a department of the English Civil Service charged with the functions of auditing the accounts of all other departments.

**Exchequer Bills**, bills of credit issued by authority of Parliament as a means of raising money for temporary purposes. They are of various sums - £100 or any multiple - and bear interest at a rate fixed for every half-year according to the rate ruling in the money-market at the time. These bills pass from hand to hand as money, and form part of the public unfunded

debt of Great Britain. *Exchequer bonds* are similar, but they run for a definite number of years (six at most) at a fixed rate of interest.

**Excise**, an inland duty or impost laid on commodities produced and consumed within a country, and also on licences to manufacture and deal in certain commodities. Excise duties were introduced into England by the Long Parliament in 1643, being then laid on the makers and vendors of ale, beer, cider, and perry. Being found to be a convenient and productive source of revenue, they continued to gain ground, and in 1919 yielded £50,068,000. In Britain the excise includes duties on spirits and beer, licences on dogs, guns, carriages, servants, plate, railways, game, &c. In 1917 an excise duty was laid on entertainments, matches, and table waters. Spirits and beer yield over £44,000,000.

**Excitomotor action**, the action of nerves distributed to muscular organs, the stimulation of which leads to movement. Thus, irritation of a nerve supplying a muscle will lead to contraction of the muscle by excitomotor action, and irritation of certain nerves distributed to blood-vessels will lead to contraction of the vessel by acting on its muscular coat.

**Exclusion, Bill of**, a bill introduced into the British Parliament during the reign of Charles II for the purpose of excluding the Duke of York (afterwards James II), he being a Roman Catholic, from the throne.

**Excommunication**, the exclusion of a Christian from the communion and spiritual privileges of the Church. Excommunication was a recognized penalty among the Jews (*John*, ix, 22), and was practised early by the Christian Church. A distinction gradually arose between a lesser and a greater excommunication, the former being a suspension from Church privileges, the latter a formal expulsion excluding from all communion with the faithful. In the Middle Ages the Popes often excommunicated whole cities and kingdoms. In such a case all religious services ceased, and the grave inconveniences thus caused made excommunication a formidable weapon in the hands of the Pope, till with frequent abuse it lost its force. Besides excommunication an extreme degree of denunciation called *anathema*, and cutting the offender off from all the hopes and consolations of the Christian faith, is used in the Roman Catholic Church. Both Luther and Calvin were in favour of the right of excommunication by the ministers of the Church. In the Church of England both the less and the greater excommunications are recognized.—*Cf.* H. Taunton, *The Law of the Church*.

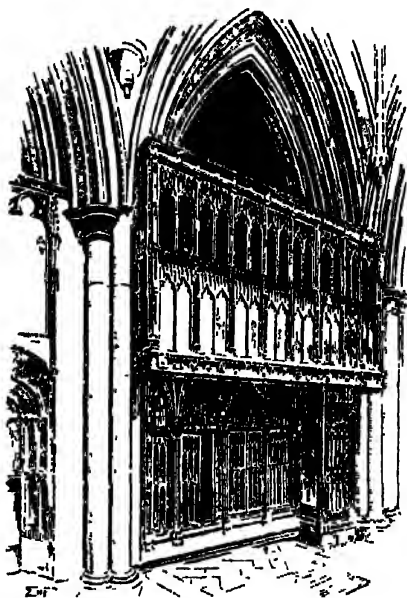
**Excretion**, in physiology, the separation and carrying off of waste matter from some organ of an animal body, a function performed by the

lungs, kidneys, and the skin, besides the action of the intestinal canal.

**Excubitorium**, in mediæval churches, a gallery where public watch was kept at night on the eve of some festival, and from which the great shrines could be seen.

**Exe**, a river of England, which rises in Exmoor, in the county of Somerset, and after a southerly course of about 50 miles falls into the English Channel at Exmouth.

**Execution**, in law, is a judicial writ grounded on a judgment of the court by which the writ



Excubitorium, St. Alban's Abbey

is issued, and is granted for the purpose of carrying the judgment into effect, by having it executed. Execution is granted by a court only upon the judgments given by the same court, not upon those pronounced by another. See *Elegit*; *Fieri facias*.

**Executioner**, the official who carries into effect a sentence of death, or inflicts capital punishment in pursuance of a legal warrant. In England the duty of executing the extreme sentence of the law devolves upon the sheriff, and in Scotland on the civic magistracy, but in practice the duty is performed by another in presence of these functionaries. In the reign of James I Gregory Brandon was the executioner of London, and hence the name Gregory has often been employed to designate executioners. In France the executioner is styled *Monsieur de Paris*.

**Exec'utive**, that branch of the government of a country by which the laws are carried into effect or the enforcement of them superintended. The term is used in distinction from the *legislative* and the *judicial* departments, and includes the supreme magistrate, whether emperor, king, president, or governor, his cabinet or ministers, and a host of minor officials.

**Exec'utor**, in law, is one appointed by a man's last will to carry its provisions into execution after the testator's death. The testator may, by the English law, appoint any person of sound mind and discretion, though otherwise under some legal disabilities as to contracting and transacting business in general, such as a married woman, or a minor. The duties of executors and of administrators are, in general, the same, the difference of the two depending mostly on the mode of appointment, the executor being nominated by the testator, the administrator being appointed by the Judge of Probate. In Scotland an executor appointed by will is styled executor *nominate*, and by authority of the court executor *ad hoc*.

**Exequatur** (Lat., 'Let him accomplish'), a written recognition of a consular or commercial agent issued by the Government to which he is accredited, and authorizing him to exercise his powers.

**Ex'eter**, a city, river-port, parliamentary county, and municipal borough of England, county town of Devon, on the left bank of the Exe, 10 miles north-west of its outlet in the English Channel. It is pleasantly situated on the summit and slopes of an acclivity rising from the river, and has handsome squares, terraces, and streets. The chief architectural feature is the cathedral (founded in 1112), a long, low building with fine west front, unique in having two towers forming its transepts, and only these two. The city has remains of the old castle and old walls, Guildhall, Albert Memorial College, training college, and St. Michael's Church. There are iron-foundries, works for agricultural implements and paper, and 'Honiton' lace is made. By a canal vessels of 300 tons can reach the city. The largest vessels remain at Exmouth. Exeter is a place of remote antiquity, having been a British settlement long prior to the invasion of the Romans, by whom it was called *Isca Damnoniorum*. It was taken by William the Conqueror in 1068. It long returned two members to Parliament, but lost one of them in 1885. Pop. 50,008.

Exeter College, Oxford, a college, originally called Stapledon Hall, founded in 1314 by Walter de Stapledon, Bishop of Exeter, who made a foundation for a rector and twelve fellows. In 1404 Edmund Stafford, Bishop of Exeter, added two fellowships and obtained leave to give the college its present name.

Exeter Hall, a large building on the north side of the Strand, London, opened in 1881, and capable of containing over 3000 persons. In it the 'May Meetings' of the several religious societies were held. It was sold in 1907 by the Young Men's Christian Association to a firm of caterers, who demolished it in 1908. The Strand Palace Hotel now stands on its site.

**Exfoliation** is the scaling off of dead tissues; thus there may be exfoliation of the skin, of bone, or of other parts from their living surroundings.

**Exhibition**, a fixed sum given for a term of years from the funds of a school, college, or university, generally upon the result of a competitive examination. An exhibition, no matter what its pecuniary value, is less of a distinction than a scholarship. At Cambridge an exhibitioner has no standing in his college different from that of the ordinary 'pensioner', while a scholar is on the Foundation of his college.

**Exhibitions**. The earliest recorded 'exhibition', in the modern acceptation of the word, is that in which, for one hundred and eighty days, Ahasuerus "shewed the riches of his glorious kingdom" at Shushan (*Esther*, i, 2-4). The first European exhibition was held at Venice in 1208; while the great fairs of Leipzig and Nijni-Novgorod partook of the same nature. But the real forerunner of the modern exhibition was that held in London by the Society of Arts in 1756, when carpets, china, and similar artistic objects were displayed. This was followed in 1781 by an exhibition of agricultural machinery. In 1797 France held a display of *objets d'art* at St. Cloud; there was another two years later at the Louvre; while a third in 1802 is memorable for the first issue of an official catalogue, and for the presence of Montgolfier the aeronaut, and Jacquard the inventor of the loom that bears his name, among exhibitors. Besides the exhibition of Irish industries, held at Dublin (1829), and the Birmingham exhibition of metal-work (1849), numerous displays were held in both Europe and America before the first International or 'Great' Exhibition of 1851. This memorable display was under the active patronage of Prince Albert, and for its accommodation the Crystal Palace was erected in Hyde Park. Its success gave the exhibition movement an impetus which produced examples at New York and Dublin (1853), both of which proved financial failures; at Munich and Melbourne (1854); Paris (1855); and at South Kensington, where was held the second International Exhibition (1862). Five years later, after Constantinople, Oporto, and Agra had, among other places, held displays, came the great Paris Exhibition, planned on a colossal scale; though the main building in the Champ



de Mars was stigmatized as 'a gasonimeter' by Napoleon III. Vienna had a magnificent but financially disastrous exhibition in 1873, and in 1876 Philadelphia celebrated the centenary of the Independence of the United States by a display. In 1878 Paris held another exhibition, for which the Trocadero was built. A series held at South Kensington (1871-4) had only a moderate success, but great popularity was attained by the 'Fisheries', 'Health', 'Inventions', and 'Colonial Exhibitions' held in the years 1883-6. Edinburgh was the scene of a forestry display in 1884, and at the same time New Orleans opened an exhibition which continued till the following year. The Paris Exhibition of 1889 was notable for the 'side-shows', which included the Eiffel Tower; while the financial result of that held in 1900, which covered 550 acres of ground and admitted thirty-nine million people, was far from satisfactory. Meanwhile Chicago had in 1893 celebrated the four hundredth anniversary of Columbus's discovery of America by a huge 'World's Fair'. The present century opened inauspiciously with the assassination of President McKinley at the Pan-American Exhibition at Buffalo (1901); Glasgow had a thoroughly successful exhibition the same year; St. Louis was the scene of another in 1904; while London organized the Franco-British Exhibition in 1908. This last owed much to the late Lord Kintyre, who had directed many previous displays, and was the designer of the 'White City' at Shepherd's Bush, where in 1914 was held the Anglo-American Exposition. The British Empire Exhibition was held at Wembley, near London, in 1924 and 1925. It provided a complete survey of the Empire and of every form of Imperial activity. It attracted 17,000,000 visitors.

**Ex'ile**, a punishment by which a person is compelled to leave the city, province, or the country where he has previously resided. It is a punishment for State criminals.

**Exmoor'**, a wild and hilly district of England, in the extreme south-west of Somersetshire, extending also into Devonshire, formerly a forest.

**Ex'mouth**, a town of England, in Devonshire, 10 miles S.S.E. of Exeter, at the mouth of the Exe. It is picturesquely situated, and is one of the best-known sea-bathing places on the Devonshire coast. The chief industries are lace-making and the fisheries. Pop. 13,614.

**Exmouth**, Edward Pellew, Viscount, a British naval officer, born at Dover in 1757, died 23rd Jan., 1833. He went to sea at the age of thirteen, served as midshipman in the *Blonde* frigate during the American War, and greatly distinguished himself at Lake Champlain. In 1782 he was made a post-captain for a brilliant action in the *Pelican*, and on the outbreak of the war

in 1793 was appointed to the command of the frigate *La Nymphe*. From this time till the peace in 1802 he was employed on active service. In 1804, on the resumption of hostilities, he was sent to take the chief command on the East India station, in the *Culloden*, of seventy-four guns; and here he remained till 1809, when he had attained the rank of vice-admiral. His next appointment was the command of the fleet blockading the Scheldt. In 1814 he was made Baron Exmouth with a pension of £2000 per annum. In 1816 he was sent with a fleet to punish the Dey of Algiers for outrages committed, and to force him to give up his Christian captives and abolish Christian slavery. Along with some Dutch war vessels he bombarded the city for eight hours, and inflicted such damage that the Dey agreed to every demand. Three thousand Christian slaves were thus restored to liberty. Lord Exmouth was made a viscount and received honours from several of the European sovereigns, and the freedom of the City of London. In 1821 he retired into private life.

**Exoascineæ**, a family of parasitic ascomycetous Fungi, distinguished by the absence of any definite fruit-body, the asci being produced in a layer on the surface of the host. The best known are *Exoascus Pruni*, the cause of the malformed fruits called 'bladder-plums' or 'pocket-plums', and *E. turgidus*, which produces the abnormal tufts of branches on silver birch known as 'witches' brooms'.

**Exobasidiineæ**, a family of parasitic basidiomycetous Fungi, resembling the Exoascineæ in most respects, but producing basidia in place of asci, a remarkable instance of parallel evolution. The commonest British species is *Erobadium Vaccinii*, which is frequent on cowberry (*Vaccinium Vitis-Idæa*) in Scotland. *E. vezans* is the cause of a serious disease of the tea-plant called 'blister-blight', which is very destructive to the Assam plantations.

**Ex'odus** (Gr. *exodos*, a going out), the name given in the *Septuagint* to the second book of the *Pentateuch*, because it describes the departure of the Israelites from Egypt. The contents of the book are partly historical, describing the departure of the Israelites from Egypt, and partly legislative, describing the promulgation of the Sinaitic law. One of the difficulties connected with this book is that, according to Scriptural chronology, the residence of the Israelites in Egypt was only 215 years, and it seems incredible that in this time "the threescore and ten souls" who accompanied Jacob to Egypt could have become the two and a half millions who left with Moses.

**Exogamy** (Gr. *exo*, outside, and *gamos*, marriage), a term applied to the custom of allowing marriages only between members who do not

belong to the same group. The study of exogamy is practically a branch of ethnology. The opposite of exogamy is endogamy, or prohibition of marriage outside the tribe. Exogamy, which among other causes may be ascribed to a desire of forming useful alliances with hostile tribes, is practised among Australian aborigines, Mongols, and American Indians, and the custom is widely distributed in various forms in all stages of civilization.—BIBLIOGRAPHY: Sir J. G. Frazer, *Totemism and Exogamy*; E. A. Westermarck, *The History of Human Marriage*.

**Exogenous Plants** (eks-oj'e-nus), or **Exogens**, old names for Dicotyledons (q.v.).

**Exogenous Structures**, in botany, are those which arise from superficial tissues of the parent organ, as stem-branches and leaves. Opposed to endogenous structures.

**Exorcism** (Gr. *exorkizein*, to expel with an oath), the casting out of evil spirits by certain forms of words or ceremonies. An opinion prevailed in the ancient Church that certain persons, those particularly who were afflicted with certain diseases, especially madness and epilepsy, were possessed by evil spirits; this was called *demoniac possession*. Over such persons forms of conjuration were pronounced, and this act was called *exorcism*. There were even certain men who made this a regular profession, and were called *exorcists*. Exorcism still forms a part of the beliefs of some Churches. In the Roman Catholic Church exorcist is one of the interior orders of the clergy.—Cf. Sir J. G. Frazer, *The Golden Bough*.

**Exostosis**, in medicine, an excrescence or growth from one of the bony structures of the body. It is generally found at the end of long bones near the joints, and in connection with the skull.

**Exothermic Compounds** are compounds which evolve heat during their formation; these are usually stable compounds, as they must be supplied with a corresponding amount of heat for their decomposition.

**Exotic**, belonging to foreign countries; a term used especially of plants. Exotic plants are such as belong to a soil and climate entirely different from the place where they are raised. They are nearly always greenhouse or hothouse plants.

**Expansion**, in physics, the increase of the dimensions of a body caused by a change of temperature. In general, bodies expand with rise of temperature, solids expanding least and gases most. This change in the dimensions of solids with temperature is expansion in length, area, and volume. These changes are referred to a unit called the coefficient of expansion, or expansion of unit length, area, or volume for 1° rise. For example, the coefficient of linear

expansion of iron is '000011; that is, a yard, say, of iron rod becomes longer by this fraction of a yard for each degree centigrade that its temperature is raised. The coefficient of volume expansion of a solid is three times its linear coefficient. Crystals have different rates of expansion along the three crystalline axes. Fused silica or quartz expands so slightly that it may be plunged when red-hot into water without being cracked. Invar, a nickel-steel alloy, which also has an extremely small coefficient of expansion, is used in making clock pendulums, which are unaffected by change of temperature. The observed expansion of liquids is affected by the expansion of the vessel containing them, and the apparent expansion of a liquid is thus always less than its real expansion. The expansion of water with rise of temperature is irregular; water contracts from 0° to 4° C., and thereafter expands at an increasing rate until the boiling-point is reached. The expansion of mercury and other liquids is employed in thermometry. Gases when kept at constant pressure expand by about  $\frac{1}{273}$ rd part of their volume at 0° C. for each degree rise.

**Expectation**, in the doctrine of chances, the value of any prospect of prize or property depending upon the happening of some uncertain event. A sum of money in *expectation* upon a certain event has a determinate value before that event happens. If the chances of receiving or not receiving a hundred pounds, when an event arrives, are equal, then, before the arrival of the event the expectation is worth half the money.—*Expectation of life*, the number of years which a man or woman of any age may be expected to live. To calculate this with any reasonable degree of probability, it is necessary to have particulars of a large number of individuals. The earliest observations were based upon the records of the registers of certain towns. Out of a number of people alive at one date the numbers still living at the end of successive years were found, and an estimate of the probable duration of life was made. With increased facilities for collecting statistics of a larger number of lives, this estimate has since been modified. It is necessarily influenced by the progress of civilization, improved methods of sanitation, increased knowledge of the best methods of treating diseases, and other causes, but the collected statistics are now so numerous that the actuaries of life assurance offices have been able to prepare tables of mortality from which the cost of life premiums and the price of annuities are calculated.

**Expectorants** are drugs used to increase and liquefy the secretion in the lungs and air-passages. The most effective are ippecacuanha, squills, apomorphine, ammonium carbonate, and

potassium iodide. Some of these are usually present in the many cough mixtures so widely used.

**Experiment**, an operation designed to discover some unknown truth, principle, or effect, or to establish it when discovered. It differs from observation in the fact that the phenomena observed are, to a greater or less extent, controlled by human agency. Experiment distinguishes the modern method of investigating nature, and to it we owe the rapid strides made in chemistry and physics.

**Expert** (Lat. *experiri*, to test), a person eminently skilled in any particular branch or profession; specifically, a scientific or professional witness who gives evidence on matters connected with his profession, as an analytical chemist or a person skilled in handwriting.

**Exploits**, River of, a river which traverses nearly the whole of Newfoundland from s.w. to n.e., and falls into the Bay of Exploits. It is about 150 miles long, and is navigable for steamers for 12 miles.

**Explosion**, a sudden violent outburst accompanied by a loud noise, and giving rise to an impulsive wave which spreads outwards from the place of explosion. Generally applied to the very rapid combustion of explosive substances which, under the influence of heat or shock, are resolved with extreme rapidity into gaseous form. Substances are termed low explosives or high explosives according as they are set off by combustion or detonation.

**Explosive Mechanism**, in botany, (1) in flowers, an arrangement for the transference of pollen to an insect-visitor by a sudden movement of floral organs. (2) In fruits, an arrangement for the forcible expulsion of seeds from a fruit brought about in various ways (see *Sling-fruits*). The spores of Ferns, ascospores, and some conidia are also liberated explosively.

**Explosives**. An explosive is a substance or mixture of substances which, by the action of a blow or of heat, can be converted very easily and suddenly into a more stable substance or substances, usually gaseous, with the simultaneous liberation of a large amount of heat. Explosives are divided into classes according to the uses to which they are put, but the line of demarcation is not always very clear. The industrial and blasting powders may be either low or high explosives. A 'low' explosive explodes by the application of heat, and burns more or less uniformly and slowly, and projects neighbouring objects to a distance. A 'high' explosive explodes under a blow, and the whole of the substance is instantly transformed, and instantly exerts its maximum pressure, creating a violent disturbance in a limited area without necessarily projecting substances to any great

distance. Service explosives, for naval and military purposes, are divided into propellants and high explosives. Sporting powders are specially modified propellant powders. Examples of these classes of explosives, with notes on their composition, are given below.

**Low Explosives**.—The best examples of the low explosive are gunpowder and similar mixtures. The constituents of the 'gunpowder' explosives are generally not explosive alone, but only when mixed. A 'gunpowder' mixture contains carbon or carbonaceous matter like wood-meal, hydrocarbons, starches, and sugars, &c., which burn owing to the presence of highly oxygenated substances like peroxides, chlorates and perchlorates, nitrates, permanganates, chromates and dichromates, all of which convey the necessary oxygen. In addition, there usually is present some very easily ignited substance like sulphur or sulphides, or phosphorus or phosphides, &c. As compared with other explosives, gunpowder or black-powder has certain advantages. It is cheap, easily ignited, insensitive to shock, and stable at moderately high temperature; it burns regularly, and its residue is non-corrosive. But it is weak in power, and produces much smoke. It is excellent for armour-piercing shell and for rings of time-fuses. Gunpowder made in different countries varies in composition, but for rifle, cannon, and sporting powders it usually contains 74 to 75 parts of saltpetre, 9 to 14 parts of sulphur, 12 to 16 parts of charcoal. For blasting powders less saltpetre and more charcoal is used. Charcoal is made by the carbonization of wood. In England dogwood, alder, and willow woods are used; in Germany alder and willow are used; in France black alder and also white alder, poplar, aspen, birch, and hazel; in Switzerland hazel wood; in Spain oleander, yew, willow, hemp stems, and vine; in Italy hemp stems. The wood is generally carbonized in iron retorts. The product is allowed to cool out of contact with air, else it may inflame. Wood burnt for ordnance powders gives a yield of 20 to 30 per cent charcoal; that for small-arms gives a yield of 40 per cent. The charcoal contains from 68 to 85 per cent carbon, from 2.8 to 3.7 per cent hydrogen, from 12 to 27 per cent oxygen, and may have up to 5 per cent ash. The saltpetre is found naturally in Chile, India, and in other countries, and is refined by crystallization from water. It is a colourless, crystalline solid. Sulphur, a pale-yellow solid, melting-point 113° C., boiling-point 444.5° C., is found in nature, and is refined to a purity of 99.5 per cent and over. It has a low ignition temperature of 261° C., and makes the powder burn more readily. Under the pressure of the press and the incorporating mill it flows and cements the minute particles of charcoal and saltpetre together. The three

ingredients are ground, mixed, sieved, incorporated or mixed in drums or mills, broken down, and then pressed, corned or granulated, and glazed. Cannon powders receive an addition of graphite to reduce the rate of burning. The powder is then dried in a stove, finished in a reel to get rid of the last traces of dust, and blended. In the United States powder for blasting contains sodium nitrate instead of potassium nitrate. The powder is cheaper and stronger, but is hygroscopic. Sprengulpetre is largely used in Stassfurt salt-mines, where a mild explosive is required, and consists of 75 parts by weight of sodium nitrate, 10 parts by weight of sulphur, and 15 parts by weight of brown coal. It is cheap, and does not produce poisonous fumes. Bobbinite is largely used in coal-mines. It is black powder with ammonium and copper sulphates, possibly also starch and paraffin wax. When gunpowder explodes, the product consists of 43 per cent gases, 56 per cent solids, and the rest water. The composition of other industrial and blasting powders is given in the sequel.

**Propellant Explosives.**—The chief propellants are nitrocellulose, also called nitrocotton or gun-cotton, and nitroglycerine.

**Nitrocellulose.**—The chief sources of cellulose are wood and cotton. When cotton is plentiful, nitrocellulose is made as follows. Cotton-waste is hand-picked to get rid of string, wood, &c.; it is opened out by a teasing-machine, which tears off small portions at a time, and the cotton is then dried to about 0.5 per cent moisture content. The cotton is then nitrated with 'mixed acid'—a mixture of about 16 per cent nitric and 75 per cent sulphuric acid and about 8 per cent water—at 15° to 25° C. After the nitration, the acid is removed and the nitrocotton boiled up in water to stabilize it. Generally nitrocotton contains about 12 to 13 per cent of nitrogen. Wet nitrocotton is quite safe although it can be detonated, but dry nitrocotton is very dangerous. To-day, paper is usually made from wood-pulp, and when the cotton supplies of Germany were stopped during the European War, nitrocellulose had to be made from wood-pulp via a form of paper crêpe prepared by the Germans from the pulp. For propellant purposes the nitrocotton is 'gelatinized', either alone or mixed with nitroglycerine, and is then worked up into different forms, such as wire, rods, grains, or tape, when it becomes controllable at will, so that the firing is not dangerous.

**Nitroglycerine.**—Mixed acid, containing 41 per cent nitric acid and 57.8 per cent sulphuric acid, is brought to 22° C. by cooling coils of brine, and pure glycerine is injected into the acid at such a rate that no glycerine accumulates unchanged, and that the temperature is kept between 15° and 22° C. When all the glycerine has

been added, the liquid is allowed to stand, and the nitroglycerine rises to the surface. It is run off to the wash-house, where it is washed free from acid and settled. The process is a dangerous one, and great care must be taken at every stage of the manufacture. The floors of the plant must be free from grit and dirt, no accumulation of liquid should be allowed anywhere, special clothing and rubber boots must be worn, no metallic implements may be used, and the plant should not be handed over for repairs except under the supervision of a responsible person. Nitroglycerine, when absorbed in a porous earth called 'Kieselguhr', is called dynamite. Kieselguhr, or simply guhr, absorbs twice its weight of nitroglycerine; cork charcoal absorbs nine times its weight. Dynamite cartridges are generally exploded by detonators.

**Preparation of Cordite; Nitrocellulose Tape (N.C.T.); Ballistite; &c.**—For cordite, the nitrocotton, freed from moisture, is mixed with nitroglycerine, and the paste or the cotton itself, if N.C.T. is to be made, is incorporated into a uniform dough with ether and alcohol. Some mineral jelly is added to render the explosive more stable. The dough is pressed through different sizes of dies according to the product desired. For rifle powder fine cords are used; for artillery, thicker cords or flat ribbons of varying thicknesses are required. The cords or tapes from the dies are cut into suitable lengths, the solvents driven off, and the products blended to obtain uniform ballistic quality. For ballistite the nitrocellulose is beaten up with nitroglycerine in water. The paste is freed from water, dried, and worked into horn-like sheets by means of rollers.

**High Explosives; Picric Acid.**—At the outbreak of the European War the chief high explosive of the Entente Powers was lyddite (in France, mélinite), also called trinitrophenol or picric acid. It is a bright-yellow solid, melting-point 122° C., sparingly soluble in water, and forms easily exploded metallic salts. It is now displaced by trinitrotoluene. Picric acid is made from phenol or carbolic acid. Phenol is obtained from coal-tar, or made synthetically from benzene. The phenol is sulphonated with strong sulphuric acid, and the phenol-sulphonic acid resulting is nitrated with strong nitric acid at about 100° C. Picric acid separates, and is washed free from mineral acid and dried. It may also be made from benzene without converting it into phenol thus: The benzene is chlorinated and gives chlorobenzene. This is nitrated into dinitrochlorobenzene, and is then treated with caustic soda to give dinitrophenol. This is then further nitrated into trinitrophenol or picric acid. Picric acid has a high melting-point, it must be used pure, is dissolved by water, it attacks metals

forming dangerous compounds, and requires troublesome plant for its manufacture. Hence it has been displaced by more suitable substances, notably by trinitrotoluene.

**Trinitrotoluene (T.N.T.).** This compound may now be made in a continuous plant. Mononitrotoluene is put in at one end of the plant and comes out as trinitrotoluene. Mixed nitric and sulphuric acid is put in at the end where the T.N.T. is obtained, and emerges, where mononitrotoluene is put in, as waste acid. T.N.T. in the past has also been made discontinuously thus: The toluene is nitrated by mixed acid into either mono- or dinitrotoluene, which is then trinitrated. The conversion into mononitrotoluene was used in the United Kingdom, France, Germany, Canada, and America; the conversion into dinitrotoluene was used in Italy. The T.N.T. emerges liquid, and is passed over a rotating drum internally cold water cooled. A knife strips the thin congealed skin of T.N.T. off. This T.N.T. is only grade 3, and for conversion into grade 1 it must be purified. Formerly this was done by means of an organic solvent, but this dangerous and expensive method has been displaced by treatment either with phenol or sodium sulphite, which gives a grade 1 product. T.N.T. is a very pale yellow solid, melting-point  $80.2^{\circ}\text{C}$ ., and therefore, melted by hot water, almost insoluble in water, burns quickly in the air, is inert, and comparatively safe to handle. It has displaced picric acid owing to its superiority, physically and chemically, over that substance.

**Tetryl or C.E. (Composition Exploding).—**Tetryl, also called tetranitrodimethylaniline, or more correctly trinitrophenylmethylnitramine, is a powerful high explosive, and is thus obtained. One part of dimethylaniline is dissolved in 10 parts of strong sulphuric acid, and the solution allowed to flow into strong nitric acid. The temperature should be kept below  $40^{\circ}\text{C}$ ., else decomposition may occur. After nitration the yellow tetryl separates out, and is filtered off and water-washed till free from acid. It is then dried in hot-air stoves. Tetryl is much more dangerous than T.N.T., and is also more poisonous to handle. No other nitro-bodies were made in England on the large scale during the European War, but on the Continent, owing to the scarcity of raw materials, dinitrobenzene, dinitrotoluene, and nitronaphthalenes, and even less important nitro-bodies, were made. Their manufacture is similar to that of those already described. Probably none of these nitro-bodies so pressed into use is as good as T.N.T.

**Detonating Substances.**—Though modern explosives are not easily exploded by a blow, they are sensitive to shock of given intensity, and lesser or different shocks will not suffice. The

'detonator' to produce the shock is set into the explosive. A complete shell carries two detonators. One, in the percussion cap, sets off the propellant charge which expels the projectile; the other, in the fuse in the nose of the shell, is ignited by the discharge of the gun, and detonates the high-explosive filling at a set interval after the discharge of the shell. Therefore, the shell can be exploded either in its flight when it is used as shrapnel shell, or on its arrival at its objective when it can be used for small-calibre artillery shell for field-guns, &c., or after its arrival when it is used for heavy howitzer and armour-piercing shell for destroying entrenched works, armoured forts, or ships. The manufacture of detonators is a very dangerous and delicate operation. Some substances (the copper acetylides) explode by a scratch, some (nitrogen iodide) by the touch of a feather or the tread of a fly, some explode even in solution when poured from one vessel into another (diazobenzeneperchlorates). Mercury fulminate is more often employed in the detonator, and is prepared from mercury, alcohol, and nitric acid. It is expensive, and most modern detonators consist of lead azide or salts of styphnic acid, with a layer of T.N.T. in a narrow aluminium cylinder.

The following is a list of the more important explosives, the different groups not being mutually exclusive:—

#### COAL-MINE EXPLOSIVES

Aetna Coal-mine Powder A, B, C: nitroglycerine explosive.  
Black Diamond: 2A, 3A, 6L: F are nitroglycerine explosives; 5, 7, 8, ammonium nitrate explosives.  
Carbonite: nitroglycerine 26, barium nitrate 4, potassium nitrate 29, wood-meal or starch flour 40, calcium carbonate 0.25.  
Du Pont Permissible: nitroglycerine, ammonium nitrate, common salt.  
Eureka: nitroglycerine and hydrated salt.  
Monobel: ammonium nitrate, nitroglycerine, wood-meal, alkali chloride.  
Red H: 7: ammonium nitrate explosives.  
Trojan Coal Powder: contains nitrostarch.

#### Austrian and Hungarian.

Chloratit: during war was used in coal-mines.  
Dynammon: ammonium nitrate potassium nitrate, red charcoal.  
Fannomite: nitroglycerine, collodion cotton, ammonium nitrate, dextrin, glycine, nitrotoluene, alkali chloride.  
Titanite: Ammonium nitrate, trinitrotoluene, curcuma charcoal.

#### Belgian.

Almit: ammonium nitrate, trinitrotoluene, ferroaluminium, salt.  
Baellite: ammonium-nitrate, trinitrotoluene.  
Densite: alkaline nitrate, trinitrotoluene, dinitrotoluene, and ammonium chloride.  
Favier Explosives: mixtures in varying proportions containing ammonium nitrate, nitronaphthalene, paraffin, and resin; higher nitrated naphthalenes, potassium nitrate, and tetryl may be present. Manufactured by the French Government as Explosifs N or Favier or Grisounites. Grisounites-couche for coal-mines have theoretical explosion temperatures of  $1500^{\circ}\text{C}$ . Grisounites-roche of  $1900^{\circ}\text{C}$ . Ammonite, Westphalite, Bellite, Roburite are explosives of this type, other ammonites, Bellite Nos. 2 and 4, Faversham powder, and negro powder have ammonium or sodium chloride added.

**British.**

**Ammonate.** Favier type; ammonium nitrate 75, dinitronaphthalene or other nitro-body, salt 20  
**Bellite.** ammonium nitrate and metadinitrobenzene, salt and starch may be added  
**Bobbinite.** the only gunpowder explosive allowed in England, not allowed in foreign mines, alkali nitrate, carbohydrates, wax may be added. Shatters coal less than high explosives.  
**Cambrite.** a Nobel carbonite plus 8 per cent of a cooling agent.  
**Denaby Powder.** ammonium nitrate, alkali nitrate, T.N.T., ammonium chloride.  
**Dynobel.** nitroglycerine 15, collodion cotton 0.5, nitro-body 3, ammonium nitrate 46, wood-meal 5.5, salt 29.5, magnesium carbonate 0.5. Limit charge, 18 to 30 ounces. Swing of ballistic pendulum, 2.35 inches.  
**Monarkite.** ammonium and sodium nitrate, nitroglycerine, nitrocotton, starch, mineral jelly, salt.  
**Monobel.** ammonium nitrate, nitroglycerine, wood-meal, salt, alkali chloride, magnesium carbonate, nitro-body may be present  
**Negro Powder.** Graissounet type, ammonium nitrate 88, T.N.T. 10, graphite 2.  
**Rex Powder.** nitroglycerine 12, salt 20, wood-meal 8, ammonium nitrate 60. Charge, 20 ounces. Swing of pendulum, 2.61 inches.  
**Rippite (Super).** nitroglycerine, nitrocotton, potassium nitrate, borax, alkali chloride.  
**Rouante.** ammonium nitrate 61, T.N.T. 16, salt 23.  
**Stomonal.** nitroglycerine, ammonium nitrate, sodium nitrate, wood-meal, wheat-flour, salt, ammonium oxalate  
**Thames Powder.** Similar to above

**Danish.**

**Aerolite.** ammonium nitrate 78.1 per cent, potassium nitrate 7.5 per cent, sulphur 8.75 per cent, tar 2.5 per cent, saw-meal 1.25 per cent, manganese dioxide 1.25 per cent, resin 0.6 per cent  
**Poudre Blanche Cornil.** ammonium nitrate, alkali nitrate, dinitronaphthalene, lead chromate.

**French.**

**Favier Explosives.** See under *Belgian* explosives.  
**Graissounet.** As above.  
**Graissounet or Gnsou Dynamite.** It is a mixture of ammonium nitrate and blasting gelatine. It is the only explosive except Graissounet allowed in the more dangerous French mines.  
**Naphthalite (Grisou).** potassium chlorate 80 per cent, aryl hydrocarbons, 12 per cent nitrocompounds not trinitro-bodies, paraffin, fatty oils, flour and other organic substances. May contain alkali chlorides and up to 4 per cent blasting gelatine.

**German.**

**Albit (Wetter).** a chlorate explosive replacing nitrates, scarce during the war.  
**Astralit (Wetter).** ammonium nitrate explosive containing some blasting gelatine. Many varieties, which may also contain rape-oil and potato-meal. Has been used in trench howitzers.  
**Carbonit.** Numerous compositions come under this name and are made in different countries. Consists chiefly of nitroglycerine and metallic nitrates. Arctic carbonite, a low-freezing mixture, contains 15.5 per cent nitroglycerine, 10.5 per cent nitrohydrocarbon, 42 per cent potassium nitrate, 31.7 per cent wood-meal, and 0.3 per cent calcium carbonate  
**Chlorazet.** potassium chlorate or perchlorate, aryl nitro-bodies, resins, and carbohydrates. For coal-mines add cooling agents  
**Detonit.** ammonium nitrate, charcoal, meal, 4 per cent blasting gelatine, neutral salts.  
**Donarit.** ammonium nitrate 80 per cent, trinitrotoluene 12 per cent, rye-flour 4 per cent, nitroglycerine 4 per cent. The standard in Germany for sensitiveness of ammonium nitrate explosives.  
**Dorfit.** ammonium nitrate, trinitrotoluene, flour, salt, alkali nitrate.  
**Dynamit.** nitroglycerine 75 per cent, Kieselguhr 25 per cent.  
**Gehlingerit.** ammonium nitrate, trinitrotoluene, flour.  
**Permonit.** a perchlorate explosive.  
**Tremont.** contains gelatinized dinitroglycerine, pea-flour, and salt.

**SOME BLASTING EXPLOSIVES**

**Ammonal.** ammonium nitrate 80 to 90 per cent, aluminium 4 to 18 per cent, charcoal 2 to 6 per cent. The more violent mixtures contain some trinitrotoluene in addition. Has been used in grenades and by Austrians in trench-howitzer bombs. Not suitable in underground workings owing to poisonous gases evolved.  
**Astralit.** a mixture of ammonium nitrate and blasting gelatine. May contain wood-meal, trinitrotoluene, paraffin-oil. Has been used for projectiles.  
**Carbodynamite.** nitroglycerine absorbed in cork charcoal instead of guhr.  
**Gelignite.** nitroglycerine 56 to 63 per cent, nitrocotton 4 per cent, wood-meal 7 per cent, potassium nitrate 27 per cent, calcium carbonate 0.2 per cent  
**Oxyliquit.** liquid oxygen absorbed in a porous combustible material. Used in construction of Simplon Tunnel  
 Very cheap; safe after misfire because oxygen evaporates off.  
**Perdit.** German mining, demolition, and rifle grenade explosive. Ammonium nitrate 76 per cent, potassium perchlorate 6 per cent, wood-meal 2 per cent, dinitrotoluene 16 per cent.  
**Rendarock.** a brand of American dynamite.  
**Sprengel Explosives.** one or both of the substances to be liquid, and mixing to occur shortly before firing. Nitric acid, alkali chloride, nitrogen peroxide on nitrobenzene, nitronaphthalene, carbon bisulphide, petrol, picric acid, Panclastite, Promethide, Rack-a-Rock, are examples of this class.  
**Tonite.** gun-cotton and barium nitrate.

**SOME HIGH EXPLOSIVES**

**Alumtol.** ammonium nitrate, trinitrotoluene, aluminium powder. Used for trench mortars, bombs, &c.  
**Amatol.** a mixture of ammonium nitrate and trinitrotoluene, used for shell-filling. Called by Germans *Hullpulver*. The Germans did not develop this explosive as much as the Entente Powers, who effected great economy of trinitrotoluene.  
**Hastine.** ammonium perchlorate, sodium nitrate, dinitrotoluene, paraffin-wax. It evolves hydrochloric acid gas.  
**Blasting Gelatine.** contains 93 per cent nitroglycerine and 7 per cent nitrocotton. It is the most powerful explosive in common use.  
**Crèyelite** is a French explosive, and contains picric acid and nitrated cresol  
**Fumyl** is a smoke-producing explosive, and contains trinitrotoluene and ammonium chloride. It was used to open poison-gas shells.  
**Granatfüllung (Shell Filling)** a term used by the Germans.  
**Granatfüllung C/84** is picric acid.  
**Granatfüllung C/02** is trinitrotoluene.  
 Other substances were used by them for shell filling, such as trinitroanisole, dinitrobenzene, hexanitrodiphenylamine, and hexanitrophenylsulphide.  
**Lyddite.** a term for picric acid, formerly used in shells.  
**T.N.T.** is trinitrotoluene or trityl.  
**Toxol** is a mixture of trinitrotoluene and trinitroxyline  
**Triplastite** is a plastic high explosive containing 70 per cent nitrotoluenes, 8 per cent nitrocotton, 20 per cent lead nitrate. Used for shell filling.

**SOME MISCELLANEOUS EXPLOSIVES**

**Anilite.** Sprengel type. French liquid explosive used in aerial bombs.  
**Centralite.** not an explosive but a stabilizer and regulator. It is dimethyldiphenylurea.  
**Collodion Cotton.** low nitration nitrocotton, soluble in a mixture of ether and alcohol. It dissolves in nitroglycerine and liquid nitro-body, preventing their exudation.  
**Gelatine Dynamite.** a mixture of blasting gelatine with potassium nitrate and wood-meal. It may also contain calcium and magnesium carbonate and mineral jelly.  
**Gelignite** is similar to Gelatine Dynamite, but contains less blasting gelatine.  
**Halakite.** contains potassium chlorate, ammonium nitrate, trinitrotoluene or other nitro-body, may contain nitrocotton, sodium nitrate, and wood-meal.  
**Pyrocollodion.** highly nitrated, soluble gun-cotton. Adopted by the United States.  
**White Gunpowder.** a mixture of potassium chlorate, potassium ferrocyanide, and sugar. Very sensitive, and only used in the laboratory.

## PROPELLANTS FOR SHOT-GUNS

Amberite: insoluble nitro-cotton 18.6 per cent, nitrates 28 per cent, soluble nitro-cotton 46 per cent, vaseline 6 per cent.

Du Pont Smokeless Powder: nitroglycerine 10 per cent, ammonium nitrate 67.5 per cent, wood-pulp 8 per cent, salt 15 per cent (for coal-mines). Soluble nitro-cotton 46 per cent, metallic nitrates 2.2 per cent (for shot-guns).

E.C. Powder: insoluble nitro-cotton 44 per cent to 48 per cent (Empire Powder), soluble nitro-cotton 30 per cent to 34 per cent, metallic nitrates 14 per cent to 9 per cent, vaseline 6 per cent to 7 per cent, camphor 4.6 per cent. Ideal Powder made by Nobels.

Neonite: Similar to the above compositions, but containing 73 per cent of insoluble nitro-cotton, 9 per cent soluble nitro-cotton. It is also made for rifled small-arms especially for rim-fire rifles.

New Explosives Company Smokeless Powder. Similar to above.

Riflate: insoluble nitro-cotton 1.7 per cent, soluble nitro-cotton 83.5 per cent, nitro-body 4.8 per cent. The nitro-cellulose is made from curcuma.

Ruby Powder: a cheap non-solvent powder, 46 per cent insoluble nitro-cotton, 4 per cent soluble nitro-cotton.

Smokeless Diamond and Stoumarkel Smokeless are similar to above.

## PROPELLANTS FOR RIFLED FIRE-ARMS

Amide Powder: ammonium nitrate, potassium nitrate, charcoal. Has also been used in German artillery.

Ammonipulver: ammonium nitrate and charcoal. Has been used by Austrian artillery, and lately reintroduced by the Germans.

Ballistite: equal parts of nitroglycerine and soluble nitro-cotton with some mineral jelly.

Cordite: the principal smokeless powder of the British Empire.

Indurite: gun-cotton and nitrobenzene. Abandoned by U.S. navy.

Neonite: a gelatinized powder. Contains nitro-cellulose, insoluble and soluble, metallic nitrates, and vaseline.

Noddite: a strip sporting-rifle powder containing nitroglycerine, nitro-cellulose, mineral jelly.

Rottweil Smokeless Powder: a gelatinized powder containing camphor and diphenylamine.

See also *Grenade; Shell; Torpedo; Fireworks; Rockets.*

**Expo'nent.** In algebra  $a^3$  denotes three  $a$ 's multiplied together;  $a^n$  means that  $n$  of the letter  $a$  are to be multiplied. These numbers or letters placed immediately above and to the right of another number or letter are called exponents, and indicate the power to which the number or letter is raised. Exponents can be fractional or negative, in which case new interpretations can be found. On the assumption that  $a^m \times a^n = a^{m+n}$  for all values of  $m$  and  $n$ ,  $a^{\frac{1}{n}}$  is interpreted as the  $n$ th root of  $a$ ,  $a^{-n}$  as the reciprocal of  $a^n$ .

**Exponential Theorem.** If  $a^x = N$ ,  $x$  is said to be the logarithm of  $N$  to the base  $a$ . There are two bases of logarithms in common use, the base 10 and the Napierian base  $e$ . The exponential theorem states that the value of  $e^x$  is given by the infinite series  $1 + x + \frac{x^2}{1.2} + \frac{x^3}{1.2.3} + \dots$

$+ \frac{x^4}{1.2.3.4} + \dots$ . Putting  $x$  equal to 1,  $e = 1 + 1 + \frac{1}{1.2} + \frac{1}{1.2.3} + \frac{1}{1.2.3.4} + \dots$ .  $e$  can be

expressed to any number of decimal places by working out the value of the terms on the right-hand side. It is an incommensurable number which to five decimal places is equal to 2.71828. See *Logarithm*.

**Exports.** See *Foreign Trade*.

**Ex Post Facto**, in law, a term designating something as done after and bearing upon something previously done; thus a law is said to be *ex post facto*, or retrospective, when it is enacted to punish an offence committed before the passing of the law.

**Exposure**, the situation of a building, &c., with respect to sun and wind; 'aspect' with regard to the quarter of the heavens. A house facing south-west or south-east will be found much healthier than one facing due north; and as it is also warmer, less fuel will be required for heating purposes.

**Expressed Oils**, in chemistry, are those which are obtainable from bodies only by pressing, to distinguish them from mineral and essential oils, which last are, for the most part, obtained by distillation.

**Extension**, (1) in physics and metaphysics, that property of a body in virtue of which it occupies a portion of space. (2) In logic, *extension* is the extent of the application of a general term, that is, the objects collectively which are included under it; thus, the word figure is more extensive than triangle, circle, or parallelogram; European more extensive than French, Frenchman, German, &c. Matter and mind are the most extensive terms of which any definite conception can be formed. Extension is contrasted with *comprehension* or *intension*.—Cf. Titchner, *Text-Book of Psychology*.

**Extincteur** (eks-tan-teur), an apparatus for the extinction of fire, consisting of a metallic case containing water and materials for generating carbonic acid. When required, the materials are brought into contact by pushing a rod which breaks a bottle containing acid, the gas mixes with the water, and the pressure generated is sufficient to project the water charged with the gas to a distance of 40 or 50 feet.

**Ex'tract**, a term to denote all that can be dissolved out of a substance by a specified menstruum, such as water, alcohol, ether, &c. In modern pharmacy the term is applied to two kinds of preparation from vegetables. One is got by digesting the plant in water or other solvent, and evaporating or distilling away the excess of solvent until the extracted matter is sufficiently inspissated. The other is got by bruising the plant in a mortar, separating the juice, warming it until the green colouring-matter separates, and filtering it off. The juice is next heated until the albumen coagulates, and again filtered. The juice is now evaporated to a



syrup, the green colouring-matter added and well mixed, and the evaporation is thereafter continued until the required concentration is attained. Extracts must be capable of being redissolved, so as to form a solution like that from which they were derived. Extracts are used in cookery, medicine, and the manufacture of paucunery.—*Extract of Meat* (*extractum carnis*) is a soft, yellowish-brown solid, or very thick syrup, which is employed as a portable soup. It is now manufactured on the large scale by processes proposed by Liebig.

**Extradition** (Lat. *ex*, out, and *tradere*, to hand over), the act by which a person accused of a crime is given up by the Government in whose territories he has taken refuge to the Government of which he is a subject. Conventions have been entered into by Britain with almost all civilized countries for the apprehension and extradition of persons charged with particular offences, especially those of the most heinous stamp, such as murder, robbery, embezzlement, arson, rape, and piracy. The Extradition Act of 1870 makes special provision that no criminal shall be surrendered for a political offence, and that the criminal shall not be tried for any but the crime for which he was demanded. Other British Extradition Acts are those of 1873, 1895, and 1906. See *International Law*.—Cf. Sir E. Clarke, *The Law of Extradition*.

**Extravaganza**, in music or the drama, a species of composition designed to produce effect by its wild irregularity and incoherence; differing from a burlesque in being an original composition and not a mere travesty.

**Extravasation** (Lat. *extra*, beyond, and *vas*, vessel), an escape of some fluid, as blood or urine, from the vessel containing it. *Blood extravasation*, in contusions and other accidents, is when blood-vessels are ruptured by the injury, and the blood finds its way into the neighbouring tissues. In some accidents to the urethra and bladder extravasation of urine is a very serious occurrence.

**Extreme Unction** has been, since an early period, one of the seven sacraments of the Roman Catholic Church. It is performed in cases of mortal disease by anointing in the form of a cross, the eyes, ears, nose, mouth, hands, feet, and reins (in the case of males). It is administered after confession and the eucharist, and is believed to remove the last stains of sin. It can only be administered by a bishop or priest, and is not applied in the case of young children or excommunicated persons.

**Exuma**, Great and Little, two of the Bahama Islands. The former is 80 miles long and 8 miles wide, and has a good harbour. Pop. 8465.

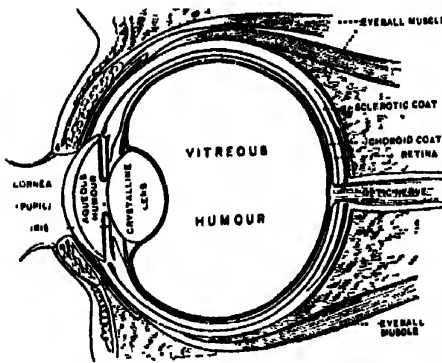
**Eyalet** (l'a-let), a former administrative division of the Turkish Empire, subdivided into

sanjaks or provinces, and kazas or districts. It was ruled by a pasha, and gave place to the vilayet on the reorganization of the empire in 1871.

**Eyck** (Ik), Hubert and Jan van, brothers, famous painters of the old Flemish school, born at Maaseyck, Hubert in 1366, Jan probably about 1385. They lived first at Bruges, whence the younger brother is called John of Bruges, and afterwards at Ghent, to which they removed about 1420. Here they executed the celebrated *Adoration of the Lamb* for the Cathedral of Ghent; a painting which, in its different parts, contains above three hundred figures, and is a masterpiece. It was in two horizontal divisions, comprising ten panels, of which only the two central ones remain at Ghent, the others being at Berlin. Hubert did not live to see it completed. He died at Ghent (1426), as did also his sister Margaret, who was likewise a painter (1431). Jan finished the work in 1432, and returned to Bruges, where he remained till his death, which took place in 1441, and executed several excellent pieces. His reputation became very great even during his lifetime, by his share in the introduction of oil-painting; the original invention of which has been incorrectly ascribed to him by many. Jan van Eyck also introduced improvements in linear and aerial perspective, and in painting upon glass. Three portraits by Jan van Eyck, *The Scholar*, *The Man with a Turban*, and *Giovanni Arnolfini and his Wife*, are in the National Gallery, London; the *Madonna of the Chancellor Rolin* is in the Louvre.—Cf. W. H. J. Weale, *John and Hubert van Eyck*.

**Eye**, the organ of vision, is an instrument presenting some analogy to a photographic camera. It is provided with a lens for focussing images upon a sensitive membrane called the *retina*. The walls of the globe of the eye are formed principally of two fibrous membranes: one white and opaque—the *sclerotic* (Gr. *sklēros*, hard)—which envelops two-thirds of the globe posteriorly; and the other transparent, and resembling a horny plate, whence its name, *cornea* (Lat. *cornus*, horny). The sclerotic is a tough fibrous coat, and is the part to which the phrase 'white of the eye' is applied. In the front of the globe the sclerotic is abruptly transformed into the transparent portion (the cornea), which is circular, and which forms a window through which one can see into the interior. A membrane, the *conjunctiva*, so named because it unites the eye to the lid, spreads over the anterior portion of the globe, and then folds back on itself and lines the internal surface of the eyelids. On the internal surface of the sclerotic is a vascular membrane called the *choroid*. This is essentially the blood-vessel coat of the eyeball. About the place where the sclerotic passes

into the cornea the choroid becomes continuous with the *iris*, a round curtain, the structure seen through the cornea, differently coloured in different individuals. In its centre is a round hole, the *pupil*, which appears as if it were a black spot. The *iris* forms a diaphragm suspended in the space behind the cornea which is filled with clear fluid, the *aqueous humour*. The *iris* consists of a framework of connective tissue, and its posterior surface is lined by cells containing pigment which gives the colour to the eye. In its substance are bundles of involuntary muscular fibres, arranged in a ring round the margin of the pupil. In a bright light the circular fibres contract and the pupil is made smaller; but in the dark these fibres relax and allow the pupil to dilate more or less widely,



Section of the Human Eye

thus allowing more luminous rays to enter the eye. Just behind the pupil is the *crystalline lens*, resembling a small, very strongly magnifying glass, convex on each side, though more so behind. Minute bands of muscle in the choroid can alter the convexity of the lens, and thus adapt its focus to the position of objects at different distances. The large space in the globe of the eye that intervenes between the retina lining its inner surface and the lens in front is occupied by a transparent jelly-like mass called the *vitreous body*. The internal surface of the choroid, or rather the pigmentary layer which covers it, is lined by the retina or nervous tunic upon which the images of the objects that we see are focussed. The retina is a very complex mechanism consisting of certain elements which are stimulated by light, and others that transmit the effects of such stimulation as a nervous current to the optic nerve which carries it to the brain. It is composed of cones and cylinders or *rods*, joined together like the stakes of a palisade, perpendicular to the plane of the membrane, and forming by their free extremities a mosaic, each microscopic division of which is about

0.0008 of a line in diameter according to Helmholtz, and represents a section of a rod. These rods and cones are believed to be the agents by whose aid the waves of light become transformed into the stimulus of a sensation. The ocular globe is put in motion in the orbit by six muscles, grouped two by two, which raise or lower the eye, turn it inward or outward, or on its antero-posterior axis. In these movements the centre of the globe is immovable, and the eye moves round its transverse and vertical diameters. These three orders of movements are independent of each other, and may be made singly or in combination, in such a manner as to direct the pupil towards all points of the circumference of the orbit. Each eye is furnished with two eyelids, moved by muscles, which shield it from too much light and keep it from being injured. They are fringed with short, fine hairs called eyelashes; and along the edge of the lids is a row of glands similar to the sebaceous glands of the skin. The eyebrows, ridges of thickened integument and muscle, situated on the upper circumference of the orbit and covered with short hairs, also regulate to some extent the admission of light by muscular contraction. In reptiles, some fishes (sharks, &c.), in birds, and in some mammals a third eyelid or nictitating membrane is present, and can be drawn over the surface of the eye so as to clear it of foreign matters, and also to modify the light. The lachrymal apparatus is composed of, firstly, the *lachrymal gland*, which lies in a depression of the orbital arch; secondly, the *lachrymal canals*, by which the tears are poured out upon the conjunctiva a little above the border of the upper lid; thirdly, the *lachrymal ducts*, which are destined to receive the tears after they have bathed the eye, and of which the orifices or *lachrymal points* are seen near the internal ends of the lids; fourthly, the *lachrymal sac*, in which the lachrymal ducts terminate, that empties the tears into the *nasal canal*. The tears, by running over the surface of the conjunctiva, render it supple and facilitate the movements of the globe and eyelids by lessening the friction. The influence of moral or physical causes increases their secretion, and when the lachrymal ducts do not suffice to carry them off they run over the lids.

*Vision*.—The retina renders the eye sensible of light, and we may therefore consider it as the essential organ of vision. The function of the other portions is to focus the luminous rays on the surface of the retina, a condition necessary for distinct vision and the clear perception of objects. The visual impressions are transmitted from the retina to the brain by means of the optic nerve. The two optic nerves converge from the eyes toward the centre of the base of the brain, where there is a partial interlace-

ment of their fibres in such a manner that a portion of the right nerve goes to the left side of the brain, and a part of the left nerve to the right side; this is called the *chiasma* or *commisure* of the optic nerves. The principal advantage of having two eyes is in the estimation of distance and the perception of relief. In order to see a point as single by two eyes we must make its two images fall on corresponding points of the retinas; and this implies a greater or less convergence of the optic axes according as the object is nearer or more remote. To accommodate the eye to different distances the lens is capable of altering itself with great precision and rapidity. When we look at a near object, the anterior surface of the lens bulges forward, becoming more convex the nearer the object; the more distant the object the more the lens is flattened. When the transparency of the cornea, the crystalline lens, or any of the contents of the globe of the eye is destroyed, either partially or entirely, then will partial or total blindness follow, since no image can be formed upon the retina; but although all the media and the cornea be perfectly transparent, and retain their proper forms, which likewise is necessary to distinct vision, yet injury or inactivity of the optic nerve, or injury of the parts of the brain with which it is connected, may produce disturbance of vision or total blindness. Defective vision may also arise from the crystalline lens being so convex as to form an image before the rays reach the retina (a defect known as short sight or myopia), in which case distinct vision will be procured by interposing a concave lens between the eye and the object of such a curvature as shall cause the rays that

Eye (A), a municipal borough, England, county Suffolk, 19 miles north of Ipswich. Up till 1885 it sent a member to Parliament, and it still gives its name to a parliamentary division of East Suffolk. Pop. 1781.

Eyebright (*Euphrasia officinalis*), a small plant belonging to the nat. ord. Scrophulariaceæ, which is common in Britain and most parts of Europe, in North Asia, &c. It is an annual, half-parasitic on grass-roots, from 3 to 8 inches high, often much branched. The whole plant has a bitter taste. Under the name of *euphrasy* it formerly enjoyed a great reputation in diseases of the eyes.

Eyemouth, a fishing-town of Berwickshire, Scotland, at the mouth of the Eye, an important place in the thirteenth century. Pop. 2477.

Eye-piece, in a telescope, microscope, or other optical instrument, the lens, or combination of lenses to which the eye is applied. As the use of a single lens limits the field of view, eye-pieces are generally formed from two lenses or lens systems, called the eye-lens and the field-lens, placed at a distance apart. The Ramsden or positive eye-piece consists of two lenses of equal focal length placed at a distance apart equal to two-thirds of the focal length of either lens. The object looked at requires to be a short distance in front of the field-lens. In the Huyghens or negative eye-piece the focal lengths of the field- and eye-lenses are in the ratio 3 to 1, and the distance between the lenses is twice the focal length of the eye-lens. As a result the image formed by, say, the objective of a telescope is in focus when between the two lenses.

Eylau (Iłou), a small town, about 28 miles distant from Königsberg, in Prussia, famous for

is corrected by convex lenses. In old age, and in fact in most people after about forty-five years of age, the elasticity of the lens becomes reduced, and convex lenses become necessary to make it possible to focus near objects. This condition is known as *presbyopia*. In the lower organisms the organs of sight appear as mere pigment spots. In higher forms, simple lenses or refracting bodies occur. Insects, crustaceans, &c., have large masses of simple eyes or ocelli aggregated together to form compound eyes—the separate facets or lenses being optically distinct, and sometimes numbering many thousands. In the cephalopods well-developed eyes presenting a distant analogy in structure to those of the highest animals are found; and in all vertebrate animals the organ of vision corresponds generally to what has been described, though they vary much in structure and adaptation to the surroundings of the animal.—Cf. J. Herbert Parsons, *Diseases of the Eye*,

and out of Feb., 1807. Both sides claimed the victory. The loss of the Allies was about 20,000 men, while that of the French must have been considerably greater.

Eyre (Ar), Edward John, Australian explorer and colonial governor, born in Yorkshire 1815, died in 1901. He went to Australia in 1833, in 1839 discovered Lake Torrens, and in 1840 explored its eastern shores and the adjacent Flinders Range. He then commenced his perilous journey along the shores of the Great Australian Bight, and reached King George's Sound, in Western Australia, a distance of 1200 miles, with a single native boy, having left Adelaide more than a year before. In 1845 he published *Discoveries in Central Australia*. After filling several governorships, he was appointed Governor of Jamaica in 1862. In 1865 he was confronted with a negro rebellion, which he crushed with some severity, and was recalled. On his return to England John Stuart Mill

and other so-called humanitarians took measures to try him for murder, but failed. Tennyson and Carlyle were among his most strenuous defenders.

Eyre, Lake, a large salt-water lake of South Australia. Area about 4000 sq. miles, but it is subject to great fluctuations in size.

Eze'kiel (Heb. *Yehesgël*, 'God shall strengthen'), the third of the great prophets, a priest, and the son of Buzi. He was carried away when young (about 599 B.C.) into the Babylonian captivity. His prophetic career extended over a period of twenty-two years, from the fifth to the twenty-seventh year of the captivity. The *Book of Ezekiel* contains predictions made before the fall of Jerusalem, 586 B.C. (chaps. i-xxiv); prophecies against some of the neighbouring tribes (chaps. xxv-xxxii); prophecies concerning the future of Israel (xxxiii-xxxix); and a series of visions relating to the circumstances of the people after the restoration.

F, the sixth letter of the English alphabet, is a labio-dental articulation, formed by the passage of breath between the lower lip and the upper front teeth. It is classed as a surd spirant, its corresponding sonant spirant being v, which is distinguished from f by being pronounced with voice instead of breath, as may be perceived by pronouncing *ef*, *ev*. The figure of the letter F is the same as that of the ancient Greek digamma, which it also closely resembles in power. As a mediæval Roman numeral F stands for 40, and with a bar above it, it is 40,000. F, in music, is the fourth note of the diatonic scale.

Faam-tea, or Faham-tea, a name given to the dried leaves of the *Angræcum fragrans*, an orchid growing in the Mauritius and in India, and much prized for the fragrance of its leaves, an infusion of which is used as a stomachic and as an expectorant in pulmonary complaints.

Faber, Frederick William, D.D., a theologian and hymn-writer, the nephew of George Stanley Faber, born at Durham in 1814, died 26th Sept., 1868. In 1845 he became a convert to Roman Catholicism, and founded the oratory of St. Philip Neri, afterwards transferred to Brompton.

Fabian Society, a Socialist organization, founded in 1888, whose object, as defined by the basis which members are required to sign, is the nationalization of all land and industrial capital for the benefit of the whole community; this result to be attained, not by any violent upheaval, but by educating the minds of the masses and gradually extending the control of the State over the factors of production. Its

Ezra, a celebrated Jewish scribe and priest. Under his guidance the second expedition of the Jews set out from Babylon to Palestine in the reign of Artaxerxes I, about 458 B.C. The important services rendered by Ezra to his countrymen on that occasion, and also in arranging, and in some measure, it is believed, settling the canon of Scripture, are specially acknowledged by the Jews, and he has even been regarded as the second founder of the nation. Josephus states that he died in Jerusalem; others assert that he returned to Babylon, and died there at the age of 120 years. The *Book of Ezra* contains an account of the favours bestowed upon the Jews by the Persian monarchs, the rebuilding of the temple, Ezra's mission to Jerusalem, and the various regulations and forms introduced by him. It is written partly in Hebrew and partly in Chaldee; this has led some to conclude that it is the work of different hands.

policy, as expounded in *Fabian Essays* (1889) by a number of its early members, is frankly opportunist, and contemplates the use of existing political machinery and the acceptance of any measure of reform which will further the ultimate aims of the society. The name is derived from that of the Roman general, Quintus Fabius Maximus, known as Cunctator from the cautious tactics by which he ultimately defeated Hannibal. Prominent members of the society at different times have been Bernard Shaw, Sidney Webb, H. G. Wells, and J. A. Hobson. The society has branches in Great Britain, the Colonies, and America, and has issued a number of publications, notably *Fabian Tracts*. A research department recently established has done useful work. The growth of the labour movement has rather diminished the importance of the society, and has led to some secessions from its ranks.

Fabii (fā'bi-i), an ancient and renowned family of Rome, who, having undertaken the duty of defending Roman territory against the incursions of the Volatines, established themselves at a post on the River Cremera. Being drawn into an ambush, they were killed to a man (477 B.C.). A boy who happened to be left in Rome became the second founder of the family. Among its celebrated members in aftertimes was Fabius Maximus, whose policy of defensive warfare was so successful against Hannibal in the second Punic War (218-201 B.C.); and Quintus Fabius Pictor, who lived about the same time and wrote a history of Rome in Greek, thus being the earliest Roman historian.

**Fable** (Lat. *fabula*, narrative), in literature, a term applied originally to every imaginative tale, but confined in modern use to short stories, either in prose or verse, in which animals and sometimes inanimate things are feigned to act and speak with human interests and passions for the purpose of inculcating a moral lesson in a pleasant and pointed manner. The fable consists properly of two parts—the symbolical representation and the application, or the instruction intended to be deduced from it, which latter is called the *moral* of the tale, and must be apparent in the fable itself. The oldest fables are supposed to be the Oriental; among these the Indian fables of Pilpay or Bidpai, and the fables of the Arabian Lokman, are celebrated. Amongst the Greeks, Æsop is the master of a simple but very effective style of fable. The fables of Phædrus are a second-rate Latin version of those of Æsop. In modern times Gellert and Lessing among the Germans, Gay among the English, the Spanish Yriarte, the Italian Pignotti, and the Russian Ivan Krylov, are celebrated. The first place, however, amongst modern fabulists belongs to the French writer La Fontaine. R. L. Stevenson wrote a collection of fables.—Cf. Walter Jerrold, *The Big Book of Fables*.

**Fabliaux** (fab'li-ô; O.F. *fabliaus*, Lat. *fabella*, dim. of *fabula*, story), in French literature, the short metrical tales of the Trouvères, or early poets of the Langue d'Oïl, composed for the most part in the twelfth and thirteenth centuries. These productions were intended merely for recitation, not for singing, and had as their principal subjects the current gossip and news of the day, which were treated in a witty and sarcastic way. The fabliaux lashed not only the clergy and nobility in their degeneracy, but even mocked the religious chivalrous spirit, and the religious and knightly doctrines and ceremonies.

**Fabre**, Jean Henri, French entomologist, born at Sainte-Leone, Aveyron, in 1823, died 11th Oct., 1915. The son of very poor parents, he received a free education at Rodez, and then went to the normal school at Vaucluse, and at the age of eighteen he began his career as teacher. He was in charge of a primary school, and in his spare time studied mathematics and physics. He subsequently became professor of physics at the College of Ajaccio, and his interest in insects having in the meantime been aroused, he turned his entire attention to entomological pursuits. His reputation as a naturalist increased, and his work was praised by Darwin. He was particularly noted for the remarkable patience with which he investigated the life-history of insects, and for his minute and painstaking observations. His works first appeared in the *Annales des sciences naturelles* from 1855-8, and were afterwards amplified in his *Souvenirs*

*Entomologiques* in 10 volumes, published between 1878 and 1907. He was made a chevalier of the Legion of Honour, and in 1912 the French Government granted him a pension. His works were translated into English by A. Texeira de Mattos.

**Fabria'no**, an episcopal city of Italy, province of Ancona. Pop. 23,750.

**Fabricius**, Gaius (with the cognomen *Luscinus*), an ancient Roman, celebrated on account of his fearlessness, integrity, moderation, and contempt of riches. After having conquered the Samnites and Lucanians, and enriched his country with the spoils, of which he alone took nothing, he was sent on an embassy to Pyrrhus, King of Epirus, who tried in vain to corrupt him by large presents. When consul in 279 B.C., Fabricius delivered up to Pyrrhus his treacherous physician, who had offered to poison his royal master for a sum of money. In gratitude for the service the king released the Roman prisoners without ransom. In 275 B.C. Fabricius was chosen censor. He died about 250 B.C.

**Fabricius**, Johann Albrecht, a German scholar, born at Leipzig in 1668, died in 1736. He became professor of rhetoric and moral philosophy at Hamburg, and published many learned works, amongst which are his *Bibliotheca Latina*, *Bibliotheca Ecclesiastica*, and *Bibliotheca Antiquaria*.

**Fabricius**, Johann Christian, German entomologist, born 1743, died 3rd March, 1808. After studying at Copenhagen, Leyden, Edinburgh, and under Linnaeus at Upsala, he obtained the post of professor of natural history in the University of Kiel. In 1755 appeared his *Systema Entomologicæ*, which gave to this science an entirely new form. In 1778 he published his *Philosophia Entomologica*, written upon the plan of the well-known *Philosophia Botanica* of Linnaeus.

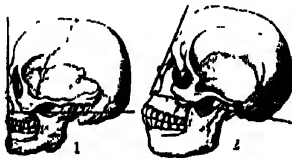
**Facciolati** (fat-cho-lá'tè), Jacopo, Italian classical scholar, born 1682, died 1760; professor in the University of Padua. The most important work with which he was connected was the *Tollus Latinitatis Lexicon*, compiled by Forcellini under his direction and with his co-operation.

**Face**, the front part of the head, the seat of most of the sense-organs. The bony basis of the face, exclusive of the thirty-two teeth (these not being in the strict sense bones), is composed of fourteen bones, called, in anatomy, the *bones of the face*. The anterior part of the brain-case (frontal bone) also forms an important feature of the face. Of all these bones the lower jaw only is movable, being articulated with the base of the skull. The other bones are firmly joined together and incapable of motion. In most mammals the jaws project much more than in men, and form the prominent feature of the

face, while the forehead recedes. See *Facial Angle*.

**Face'tiæ**, humorous sayings, witticisms, jests. There have been many collections of such. Amongst the most notable are the *Astcia* (Jests) of Hierocles, an old Greek collection, the *Liber Facctiarum* of Poggio Bracciolini, and Joe Miller's *Jest-Book*.

**Facial Angle**, an angle of importance in the method of skull measurement introduced by Camper, the Dutch anatomist, who sought to establish a connection between the magnitude of this angle and the intelligence of different animals and men, maintaining that it is always greater as the intellectual powers are greater. Suppose a straight line drawn at the base of the skull, posteriorly across the external orifice of the ear to the bottom of the nose, and another straight line from the bottom of the nose, or from the roots of the upper incisors, to the most



Facial Angle

1, European. 2, Negro.

prominent part of the forehead, then both lines will form an angle which will be more or less acute. In apes this angle is only from  $45^{\circ}$  to  $60^{\circ}$ ; in the skull of a negro, about  $70^{\circ}$ ; in a European, from  $75^{\circ}$  to  $85^{\circ}$ . In another mode of drawing the lines the angle included between them varies in man from  $90^{\circ}$  to  $120^{\circ}$ , and is more capable of comparison among vertebrate animals than the angle of Camper. Though of some importance in the comparison of races, this angle is fallacious as a test of individual capacity.

**Facial Nerve**, a motor nerve which supplies the muscles of expression on either side of the face. Injury to this nerve produces *facial paralysis*, the result of which is that the affected side is smooth, unwrinkled, and motionless, the eyelids are wide open and cannot be closed, and the muscles of the sound side having it all their own way drag the mouth to that side.

**Factor**, in arithmetic, is any number which divides a given number without a remainder, thus 3, 5, 7 are all factors of 105. In algebra, any expressions multiplied together to form a product are said to be factors of the product; for example,  $x + 1$ ,  $x + 2$ ,  $x + 3$  are factors of  $x^3 + 6x^2 + 11x + 6$ .

**Factor**, in commerce, an agent employed to do business for another in buying or selling, or in the charge of property. A factor differs from

a broker in holding a wider and more discretionary commission from his employer, in being able to buy and sell in his own name, and in having a lien on goods for his outlay. The difference, however, depends so much upon the usage of the particular trade, or upon the special instructions constituting the agency, that no exact line of demarcation can really be drawn between them. The term *factor* has in common usage generally given place to the terms agent and broker, the former applied in the more general, the latter in the more restricted sense. It is still retained in some special cases, as in that of house-factors and factors on landed property in Scotland, who have charge of the letting and general management of house property, farms, &c.; called in England estate agents.

**Fac'tory** (from *factor*), a name which appears originally to have been given to establishments of merchants and factors resident in foreign countries; it now more commonly signifies a place in which the various processes of a particular manufacture are carried on simultaneously. The rapid growth of factories in this sense is a comparatively recent development of industry, resulting from the free use of machinery and the consequent subdivision of labour. Amongst the advantages of the factory system are generally counted: first, increased productiveness arising from the minute division of labour; second, the mechanical accuracy and the cheapness of the product turned out by machinery; third, the facilities for union and co-operation for common improvement afforded by bringing large masses of workmen together. But this last consideration is probably more than counter-balanced by the smaller amount of independent intelligence called forth in the individual worker, through the monotony of the minutely subdivided operations. Decided disadvantages of the factory system are the unhealthiness of the crowded rooms, where the air is full of deleterious elements; and the increasing demand on the labour of women and children, interfering as it does with the economy of domestic life.—

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**Factory Acts**, Acts passed for the regulation of factories and similar establishments. Considering that women and children were not qualified fully to protect themselves against the strain of competition, the British legislature has passed a series of Acts to regulate the conditions of their employment in factories. The immediate occasion of the first Act passed to regulate factory employment in England was the outbreak of an epidemic disease which committed great havoc among the younger persons employed in factories in the district round Manchester at the beginning

of the nineteenth century. An Act was passed (1802) in which provision was made for the regular cleansing and ventilation of mills and factories, and also for limiting the hours of labour to twelve daily. In 1819 an Act followed which prescribed an hour and a half for meals in the course of a working day, and prohibited children under nine years of age being employed in factory work at all. Various Acts were passed up to 1878, when a general Factory and Workshop Act was passed, consolidating the previous series of statutes. Its scope was extended by a further series of enactments, until in the year 1901 the last general Act was passed, which consolidates and amends all previous legislation. The Act contains general provisions regarding drainage, sanitary conveniences, overcrowding, ventilation, fencing of dangerous machinery, &c. Factories are distinguished from workshops as making use of steam or other mechanical power. In textile factories the hours of labour for women and young persons (the latter between 14 and 18 years of age) are restricted to 10, but only 8½ on Saturday and 50 in the week. In non-textile factories and workshops the hours may be 10½ per day and 60 per week at most. Children (of 12 to 14 years) were not allowed to be employed more than 0½ hours on any one day. (The Education Acts now prohibit almost entirely the employment of 'school children' in factories and workshops.) Provision is made for a certain number of annual holidays. Special provisions for particular kinds of factories are made, and under these the employment of females and young persons is regulated in bleaching- and dyeing-works, lace-factories, manufactories of earthenware, lucifer matches, percussion caps, cartridges, blast-furnaces, copper-mills, forges, foundries, manufactories of machinery, metal, india-rubber, gutta-percha, paper, glass, tobacco, letterpress printing, bookbinding, &c. The Act of 1901 included laundries carried on by way of trade or for the purposes of gain. An Act of 1907 extended the Act of 1901 to laundries carried on as ancillary to another business or incidentally to the purposes of any public institution. A short Act passed in 1911 gave power to make regulations applicable to cotton-cloth factories. Certain exceptions in regard to working overtime are provided for; thus women may sometimes work 14 hours a day. So far there has been no direct interference in any of the Factory Acts with the labour of adult male persons; but it is obvious that indirectly the position of the male labourer also is affected by legislation of this sort.

**Faculæ** (Lat. *facula*, a torch), bright markings on the sun's disc, i.e. portions more brilliant than the general surface. They are supposed to be parts of the luminous surface, or photosphere,

which are elevated to a greater height, and therefore suffer less absorption of their light in its passage through the overlying gases and vapours. Like the spots, they are in a state of constant change, and exhibit a similar periodicity in numbers and extent.

**Faculties**, Court of, in English law, a jurisdiction or tribunal belonging to the archbishop. It does not hold pleas in any suits, but has power to grant licences or dispensations, such as, to marry without banns, or to remove bodies previously buried.

**Faculty**, the members, taken collectively, of the medical or legal professions; thus we speak of the medical faculty, and (in Scotland) of the faculty of advocates. The term is also used for the professors and teachers collectively of the several departments in a university; as, the faculty of arts, of theology, of medicine, or of law.

**Faculty**, in law, is a power to do something, the right to do which the law admits, or a special privilege granted by law to do something which would otherwise be forbidden.

**Fæces**, the excrementitious part evacuated by animals. It varies, of course, with different species of animals, according to their diet. The main constituents are unassimilable parts of the food, on which the digestive process has no effect, and other portions, quite nutritious, but which have escaped digestion, also certain waste matters, &c. In disease the composition varies extremely.

**Fæd** (fæd), John, R.S.A., artist, born in Kirkcudbrightshire in 1820, died in 1902. He showed artistic talent at an early age, and in 1841 went to Edinburgh to study. Some years later he acquired a considerable reputation, and was elected to the Royal Scottish Academy in 1851. Among his principal works are: *Shakespeare and his Contemporaries*; *An Incident of Scottish Justice*; *The Morning after Flodden*; *A Wappenshaw*; two series of drawings illustrating *The Cotter's Saturday Night* and *The Soldier's Return*; *John Anderson, My Jo*; *Auld Mare Maggie*; *The Gamekeeper's Daughter*; *The Hiring Fair*.

**Fæd**, Thomas, R.A., younger brother of the preceding, born at the same place in 1826, died in 1900. He studied in Edinburgh, where at an early age he became known as a clever painter of rustic subjects. In 1852 he settled in London, where he won a high reputation. The subjects he painted are for the most part domestic or pathetic, and in these he invented and told his own story, and that with a success that emulates Wilkie. Among his principal works are: *Sir Walter Scott and his Friends* (1840), *The Mitherless Bairn* (1855), *The First Break in the Family* (1857), *Sunday in the Backwoods* (1859), *His Only Pair* (1860), *From Dawn to Sunset* (1861), *The Last o' the Clan* (1865). A



number of Faed's works have been engraved in large size, and have been very popular.

**Faenza** (fā-en'za), an episcopal city of N. Italy, in the province of and 19 miles southwest of Ravenna. It is supposed to have been the first Italian city in which the earthenware called *faience* (q.v.) was introduced. The manufacture still flourishes here, and there is also a considerable trade in spinning and weaving silk. Pop. (commune), 40,164.

**Fagaceæ**, a nat. ord. of apetalous Dicotyledons, all trees and shrubs, mostly natives of temperate regions. It includes the beeches and oaks, and the sweet chestnut (*Castanea*).

**Fagging**, a custom which formerly prevailed generally at most of the English schools, and is still practised at Eton, Winchester, Harrow, Rugby, and one or two other places. It consists in making the junior boys act as servants or 'fags' in the performance of multifarious menial offices for elder boys, such as carrying messages or preparing breakfast for their master, in return for which the elder boy accepts a certain responsibility for keeping order, and becomes the recognized adviser and protector of his 'fags'.

**Faggot-vote**, a term formerly applied in Britain to a vote procured by the purchase of property so as to constitute a nominal qualification without a substantial basis. Faggot-votes were chiefly used in county elections for members of Parliament. The way in which they were usually manufactured was by the purchase of a property which was divided into as many lots as would constitute separate votes, and given to different persons, who need not be resident members of the constituency. The practice disappeared after the Reform Act of 1884.

**Faguet**, Émile, French literary historian, critic, and journalist, born at La Roche-sur-Yon in 1847, died in 1916. He became professor of poetry at the Sorbonne in 1897. Endowed with a keen power of analysis and a wealth of original ideas, he was one of the most brilliant French critics of the nineteenth century. Whilst praising the literature of the seventeenth century, Faguet somewhat depreciated the writers of the eighteenth century. Among his numerous works are: *Le théâtre contemporain* (1880-91), *Dix-huitième siècle* (1890), *Seizième siècle* (1893), *Drame ancien et drame moderne* (1898), *Histoire de la littérature française* (1900), *Propos littéraires* (1902), *Initiation into Literature*, and *Initiation into Philosophy*.

**Fagus**. See *Beech*.

**Fahlerz** (fā'erts), or grey copper ore, is of a steel-grey or iron-black colour. It occurs crystallized in the form of the tetrahedron, also massive and disseminated. Its fracture is uneven or imperfectly conchoidal. Specific gravity, 4.5-5.1. *Tetrahedrite*, the typical species, is composed

of copper, sulphur, and antimony. Part of the copper is often replaced by iron, zinc, silver, or mercury, and part of the antimony by arsenic.

**Fahlunite**, a mineral of a greenish colour occurring in six-sided prisms. It is a pseudomorph after *iolite*, and consists mainly of hydrous aluminium silicate. It takes its name from Fahlun in Sweden.

**Fahrenheit** (fā'rén-hīt), Gabriel Daniel, German physicist, known for his arrangement of the thermometer, was born at Danzig in 1686, died in 1736. Abandoning the commercial profession for which he had been designed, he settled in Holland to study natural philosophy. In 1720 he effected a great improvement by the use of quicksilver instead of spirits of wine in thermometers. He invented the Fahrenheit scale (see *Thermometer*), and made several valuable discoveries in physics. He was elected a fellow of the Royal Society of London in 1724.

**Faldherbe** (fā-derb), Louis Léon César, a French general, born in 1818, died in 1880. He entered the army in 1840, served in Africa and the West Indies, was appointed Governor of Senegal in 1854, and afterwards of a district in Algiers from 1867 to 1870. After the fall of Napoleon III, he was summoned by the Government of the National Defence to France and appointed commander of the army of the north. He fought some bloody but indecisive battles with the Germans under Manteuffel and Goeben. After the war he was elected to the Assembly by Lille, his native place, but on the triumph of Thiers retired from politics to private life. He wrote *Épigraphie Phénicienne*, and valuable monographs on Senegal, the Sudan, and other parts of Africa.

**Faience** (fā-yens'), imitation porcelain, a kind of fine pottery, superior to the common pottery in its glazing, beauty of form, and richness of painting. Several kinds of faience are distinguished by critics. It derived its name from the town of Faenza, in Italy, where a fine sort of pottery called *majolica* was manufactured as early as the fourteenth century. The *majolica* reached its greatest perfection between 1530 and 1560. In the Louvre, the Musée de Cluny, the British and Victoria and Albert Museums, at Berlin, and at Dresden are rich collections of it. The modern faience appears to have been invented about the middle of the sixteenth century, at Faenza, as an imitation of *majolica*, and obtained its name in France, where a man from Faenza, having discovered a similar kind of clay at Nevers, had introduced the manufacture of it. True faience is made of a yellowish or ruddy earth, covered with an enamel which is usually white, but may be coloured. This enamel is a glass rendered opaque by oxide of tin or other

suitable material, and is intended not only to glaze the body, but to conceal it entirely. See *Pottery*. — Cf. M. L. Solon, *The Old French Faience*.

**Failly** (fā-yē), Pierre Louis Charles Achille de, French general, born in 1810, died in 1892. He distinguished himself in the Crimean War, and commanded a division against the Austrians in 1859. He was the means of introducing the Chassepôt rifle into the French army, and commanded the troops which dispersed Garibaldi's irregulars at Mentana. At the outbreak of the Franco-German War Failly received the command of the 5th Corps, but was very unfortunate or unskilful in his organization of operations. His masterly inactivity in the early weeks of the war caused great popular indignation in France. Sedan ended his career as a soldier.

**Fallsworth**, a town of England, in Lancashire, 4 miles north-east of Manchester, with cotton-mills. Silk-weaving and hat-making are also carried on. Pop. 16,972.

**Fainéants** (fā-nā-ān; Fr., 'do-nothings'), a sarcastic epithet applied to the later Merovingian kings of France, who were puppets in the hands of the mayors of the palace. Louis V, the last of the Carlovingian dynasty, received the same designation.

**Fainting**, or **Syncope**, a sudden suspension of the heart's action, of sensation, and the power of motion. It may be produced by loss of blood, pain, emotional disturbance, or organic or other diseases of the heart. It is to be treated by placing the patient on his back in a recumbent position or even with head slightly depressed, sprinkling cold water on his face, applying stimulant scents to the nostrils, or anything which tends to bring back the blood to the brain. The admission of fresh cool air and the loosening of any tight articles of dress are important.

**Fairbairn**, Patrick, Scottish theologian, born 1805, died 1874. He became a minister of the Established Church, but joined the Free Church at the disruption in 1843. In 1833 he was appointed professor of divinity in the Free Church College, Aberdeen, and in 1836 principal of the Free Church College, Glasgow. Among his works are: *Typology of Scripture*; *Jonah: his Life, Character, and Mission*; *Ezekiel: Prophecy*; *Hermeneutical Manual*; *Pastoral Epistles of St. Paul*. He edited and wrote extensively for the *Imperial Bible Dictionary*.

**Fairbairn**, Sir William, British civil engineer, born at Kelso, Roxburghshire, in 1789, died 18th Aug., 1874. He was apprenticed as an engine-wright at a colliery in North Shields, and commenced business on his own account in Manchester with James Lillie in 1817, where he made many improvements in machinery, such as the use of iron instead of wood in the shafting of

cotton-mills. About 1831, his attention having been attracted to the use of iron as a material for shipbuilding, he built the first iron ship. His firm became extensively employed in iron shipbuilding at Manchester and at Millwall, London, and had a great share in the development of the trade. He shares with Stephenson the merit of constructing the great tubular bridge across the Menai Strait. Fairbairn was one of the earliest members of the British Association for the Advancement of Science, of which he was president in 1861 and 1862. He was created a baronet in 1869. Sir William wrote many valuable professional books and papers, amongst which are: *On Canal Steam Navigation* (1831); *Iron: its History, Properties, and Manufacture* (1841); *Application of Iron to Building Purposes* (1854); *Iron Ship-building* (1865). His brother Sir Peter, born 1790, died 1861, had also great mechanical ability, and founded large machine-works at Leeds.

**Fairfax**, Edward, the translator into English verse of Tasso's *Jerusalem Delivered*, was the natural son of Sir Thomas Fairfax of Denton, and born in the last quarter of the sixteenth century. He settled at Newhall, in the parish of Fewston, Yorkshire, to a life of studious leisure. The first edition of his translation bears the date of 1600. One or two eulogues by him also remain. He died in 1635.

**Fairfax**, Thomas, Lord, parliamentary general during the English Civil War, born in 1611 at Denton, in Yorkshire, died at Nun Appleton, Yorkshire, 12th Nov., 1671. He was the son and heir of Ferdinando, Lord Fairfax, to whose title and estates he succeeded in 1648. After serving in the Netherlands with some reputation, he returned to England, and on the rupture between Charles I and the Parliament joined the forces of the latter. In 1642 he was appointed General of the Horse, and two years later held a chief command in the army sent to co-operate with the Scots. In 1645, on the resignation of the Earl of Essex, Fairfax became general-in-chief of the Parliamentary army. After the victory at Naseby he marched into the western counties, quelling all opposition, put down the insurgents in Kent and Essex in 1647, and captured Colchester. In April, 1649, he was occupied along with Cromwell in suppressing revolt in the army; but positively declined to march against the Scottish Presbyterians. He was a member of Cromwell's first Parliament. He co-operated in the restoration of Charles II, being one of the committee charged to secure his return.

**Fairford**, a town in Gloucestershire, England, 8 miles east by south of Cirencester, with a church the twenty-eight windows of which are filled with beautiful stained glass, formerly ascribed to Albert Dürer, but now known to have been

designed and executed in England. Fairford was the birth-place of John Keble. Pop. 1410.

**Fair Head**, a basaltic promontory on the north coast of Ireland, County Antrim, rising to the height of 636 feet.

**Fairies and Elves.** The fairies of folk-belief must be distinguished from the fairies of imaginative literature. Shakespeare, for instance, drew upon the fairy-lore of living tradition to create a new fairy mythology (as in *A Midsummer Night's Dream*) which became a literary convention. In the fairy stories of Hans Andersen the folk-material was similarly used in a free and individual manner. A distinction must likewise be drawn between the Celtic fairies and the Teutonic elves. The former are mainly females, like the nymphs of Homer, ruled over by a fairy queen, while the latter are mainly males, ruled over by an elf-king. Mab, the fairy queen, had no consort in British fairy literature until Oberon, King of the Fairies, was imported from mediæval romance. His name 'Auberon', anciently 'Alberon', is identical with that of the German elfin king 'Alberich'. Indeed, the very names 'fairy' and 'fey' were introduced into these islands from abroad. More than one class of supernatural beings referred to in Gaelic as the *side* (Irish) or *sith* (Scottish), and pronounced *shee*, are now called 'fairies'. These include the Danann deities of Irish mythology and 'the mothers' (Y Mwnau) of Welsh folk-lore. The word *side* or *sith* has the secondary meaning of 'peace', and refers to the silence of death and the silence of fairy movements. It may also be translated as 'supernatural', 'Otherworld', or 'unearthly'. Mysterious diseases that come in epidemics and afterwards disappear are referred to as diseases of the *side* or *sith*. Cat demons are *cait sith*, the cuckoo is *cun sith*, the mythical 'water horse' is *each sith*, a monstrous dog that passes over land and sea by night is *cu sith*, while the 'will-o'-the-wisp' is *teine sith* ('supernatural fire'). In Iceland *side* refers to the dwellings (earth mounds, &c.) of the Dananns, &c., as well as to the supernatural inhabitants. The fairies of folk-belief always come from the west on eddies of wind, and cannot be seen except by those who have 'second sight', or those whose eyes have been anointed with a green balsam possessed by fairies. Sometimes the fairies render themselves visible to all, but one who grasps the garment of a fairy finds his hand closing on nothing. The usual height of fairies is about 3 feet, but they have power to shrink and pass through a crack in a door. They may also assume great stature. The Danann *side* of Ireland are of human or above human height. In Scotland 'green ladies' are of ordinary human size. The chief fairy colours are blue (the eyes), golden (the hair), and green, red, and grey (for

clothing). Occasionally fairy beings are white and black. A black fairy with a red spot above the heart is referred to in Scottish stories, but is rare. He can be slain by piercing the red spot. The *side* or *sith* may be attired entirely in green with red caps, or have red cloaks and green skirts. A beautiful fairy queen may suddenly transform herself into an ugly old hag with black and white face and garments, as did the fairy who carried off Thomas the Rhymer to the Underworld. The dead were supposed to go to Fairyland, the Pagan Paradise. Those who died before their time were doomed to visit their former haunts as 'green ladies', i.e. green ghosts, until their measure of life was completed. Stories that tell of visions of the dead in the Underworld refer to them feasting and dancing, or reaping corn and plucking fruit in well-watered valleys. The resemblance of the Celtic Agricultural Paradise to the Otherworld of the Egyptian Osiris, which was originally situated under the ground, is of special interest. Both in the Underworld Paradise and on the 'Isles of the Blest' (the Celtic *Avalon* or 'apple land' and 'Land of the Ever-Young') is a tree of life, which may be an apple tree, a hazel tree, or a rowan tree. The apples, nuts, or berries confer longevity on the gods and the souls of human beings that partake of them. On those human beings who have won their favour, the fairies bestow weapons, implements, musical instruments, songs, tunes, and medicines, and the power to work charms and foretell future events. In the Underworld, fairies engage in metal working and other industries. Sometimes they visit houses, and spin and weave with supernatural skill and speed in a single night big bales of clothing material, or make beautiful garments. Fairies possess gems, gold, silver, and copper in their underground dwellings. Cornish miners hear them working in their mines. The 'banshee' (Ir. *ben-side*) is a Fate who is seen washing the blood-stained clothing, or the 'death clothes', of those who are doomed to die a sudden death. She either howls, or sings a weird song, or can be heard 'knocking' as she strikes the clothing with a beetle during the washing, when a tragedy is at hand. Fairy women of great beauty have human lovers, but vanish for ever after a few meetings, with the result that their lovers become demented. Fairy men (*fer-side*) likewise upset the minds of girls. The fairies abduct human children, leaving 'changelings' in cradles, or carry off wives to act as 'wet nurses' or midwives. Men who die suddenly are supposed to be transported to Fairyland. King Arthur, the Rev. Mr. Kirk of Aberfoyle, Thomas the Rhymer, and others were removed to the Fairy Paradise. Among the Celtic *side* are *pixies*, *geniti-glinni* (valley geni), *Bocanachs* (male goblins), *Bananachs* (female

goblins), *Demna aer* (spirits of the air), &c. Fairies may appear in animal forms, chiefly as beautiful birds. Elves are workers in metals, like Wayland Smith, and guardians of treasure who assume the forms of fish, otters, serpents, &c. Black elves dwell under the ground, and white elves haunt the air and the sea. Sea-elves are 'nækkers'. The Greek 'Fates', like the Celtic fairies, spin, weave, and embroider wedding and other garments in a single night for those they favour, and sometimes appear in groups of three, as old hags, to foretell tragic events or work spells. Celtic 'women of the side' sometimes appear in groups of three. The nereids are, like the fairy ladies, beautiful and capricious, and are likewise invariably blue eyed and golden haired. 'Nereid born' refers to the changeling idea. Nereids travel on whirlwinds, and, like the Celtic faeries, cause spinning spirals of dust on highways. They accept offerings of food. Lacon, the shepherd in Theocritus (Idyll V), sings, "I will set a great bowl of white milk for the nymphs". In the Scottish Highlands the milk offering was poured on the ground for those 'under the earth', or into a hollowed stone (*clach-na-grungach*). The Indian 'nagas' have power to change from serpent to human form, or to appear as half-human, half-reptile beings. Like the Celtic fairies, they have been referred to by some writers as aborigines who hid from invaders in earth-houses, in forests, and among the hills. In this connection P. C. Roy, the translator of the *Mahābhārata*, writes: "Nagas are semi-divine and can move through air and water and ascend to high heaven itself when they like, and have their home at Patala (the Underworld). To take them for some non-Aryan race, as has become the fashion with some . . . is the very height of absurdity. . . . None of these writers, however, is acquainted with Sanskrit, and that is their best excuse." The fairies and elves of China and Japan resemble those of Europe. In Polynesia there are fairy-like beings. They are called *Patupaiarehe*, and dwell in lonely places, appearing only at night. Human beings receive gifts from them, or knowledge of how to make nets, weapons, &c. The changeling idea is as prevalent as in Europe. It is of special interest to find that the Polynesian fairies have, like the Celtic, fair hair and white skins. Other peoples believe in the existence of fairy-like beings. See *Folklore*.—BIBLIOGRAPHY: T. Keightley, *Fairy Mythology*; E. S. Hartland, *Science of Fairy Tales*; Delattre, *English Fairy Poetry from the Origins to the Seventeenth Century*; H. A. Giles, *China and the Chinese*; J. G. Lawson, *Modern Greek Folklore and Ancient Greek Religion*; Sir George Grey, *Polynesian Mythology*; P. W. Joyce, *Social History of Ancient Ireland*.

**Fair Isle**, an island lying nearly midway between the Orkney and Shetland Islands, 3 miles long by 2 broad. It is inaccessible except at one point, and rises to the height of 711 feet. Some grain is grown, but the surface is mostly in pasture. The men engage in fishing; the women knit a well-known variety of hosiery, introduced, it is said, by Spaniards who escaped from the wreck of one of the vessels belonging to the Spanish Armada. There are two light-houses. Pop. 147.

**Fair Oaks, Battle of**, fought at Fair Oaks, in Virginia, 7 miles east of Richmond, between the Confederates under General Johnston and the Union troops under General M'Clellan, 31st May, 1862. The loss on each side was nearly 6000 men; the result was indecisive.

**Fairs** (Lat. *feria*, holiday, connected with *festus*, feast), periodical meetings of persons having goods or wares for sale in an open market held at a particular place, and generally for the transaction of a particular class of business. The origin of fairs is obviously to be traced to the convenience of bringing together at stated times the buyers and sellers of the stock-produce of a district. In Europe the numerous festivals of the Church afforded the most favourable opportunity for the establishment of these markets. This association is indicated in the German name of a fair, which is identical with that used for the ceremony of the mass. In the Middle Ages fairs were of great importance, and were specially privileged and chartered by princes and magistrates, public proclamation being made of their commencement and duration. But modern facilities of communication have much diminished the necessity for periodical markets, and it is now chiefly amongst agriculturists that they are of much importance, large agricultural meetings being held in various districts for the sale of cattle and horses, and for the exhibition of agricultural implements. There are also, especially in Scotland, a considerable number of hiring fairs for farm servants. In the less developed commerce of the East, however, they still retain much of their ancient importance and magnitude. In Europe the most important fairs of the present day are those at Leipzig and Frankfurt-on-the-Main in Germany, at Lyons in France, and Nijni-Novgorod in Russia. The last is, indeed, the largest fair in the world. The fairs of Great Britain now mostly consist of the weekly market-days of country towns and the agricultural meetings already mentioned. In many places the old fair-days are still kept, but are now merely an assemblage of penny-theatres, peep-shows, and such amusements. Amongst the fairs which were once celebrated saturnalia, or rather bacchanalia, may be mentioned Donnybrook Fair in the county of Dublin;

Bartholomew and Greenwich Fairs, London; and Glasgow Fair. The first three are now extinct. Fairs in the sense of markets are unknown in the United States, but the term is usually given to ladies' fancy bazaars, collections of fine art or the higher industries for public exhibition.—*Cf.* C. Walford, *Fairs, Past and Present*.

**Fair Trade**, an economical policy advocated by many in Britain, which, while not opposed to free trade in principle, would meet the prohibitory tariffs that foreign countries may put on British goods by placing equally heavy duties on goods sent from these countries to Britain. See *Free Trade*.

**Fairweather, Mount**, on the west coast of North America, in Alaska territory. It rises to the height of 14,900 feet, and is covered with perpetual snow.

**Fairy Ring**, a circle, or part of a circle of grass, of a darker colour and more luxuriant growth than the surrounding herbage, superstitiously associated with fairy revels. Actually it is due to the growth of a subterranean fungus-mycelium, which gradually spreads outwards from a central point of origin, the older parts dying and serving as manure for the grass, which appears even more vigorous than it really is by contrast with that on the outermost edge of the ring, where the living mycelium has a bad effect upon the grass-roots. The commonest fairy-ring fungus is *Marasmius oreades*, the fairy-ring champignon.

**Faith**, the assent of the mind to the truth of what is declared by another, resting on his authority and veracity, either without other evidence or on probable evidence of any kind. In a special sense the term faith is used for the assent of the mind to what is given forth as a revelation of man's relation to God and the infinite, i.e. a religious faith. In Christian theology we have: first, *historical* or *speculative faith*, or belief in the historic truthfulness of the Scripture narrative and the claims of Scripture to an inspired and supernatural origin; second, *evangelical* or *saving faith*, that emotion of the mind (as Dwight defines it) which is called trust, or confidence exercised towards the moral character of God, and particularly of the Saviour.—*Cf.* W. R. Inge, *Faith and its Psychology*.

**Faith-healing**. The tenets of the Peculiar People and of other believers in healing by faith differ from the views of Christian Scientists in this respect: that, while the latter hold pain and disease to be illusions of the imagination, the faith-healer admits their existence, but affirms the possibility of their removal by non-scientific means. Some make use of anointing with oil, while others hold prayer and the laying-on of hands to be the only requisites. Faith-healing traces its source to the raising of the

apparently dead, the curing of the sick, the restoration of sight to the blind, and other recorded miracles of Christ; thence through the miracles of the disciples and their successors, down to the performances of Dorothy Trudel in Switzerland, and the displays of Dowie in London (1904). Faith-healers flourish extensively in Sweden and America, while even in England 'Bethshans' (houses of cure) have been established. Faith, or some may say credulity, attributes the alleged cures to supernatural agency; science sees in them the action of 'suggestion', with an exalted and emotional state of mind in the patient, more especially when surrounded and encouraged by a crowd of expectant and credulous lookers-on. Excessive reliance on his or her own powers has not seldom brought a faith-healer within the menace of the law, owing to neglect to employ a qualified medical man, and the consequent death of the sufferer. In a broad sense of the term the belief in healing by faith has been at the root of 'touching' for the King's Evil, a practice followed by several English and French sovereigns (see *Macbeth*, iv, 3, 141); of the value placed on relics; of alleged cures effected at such 'holy places' as St. Wulfred's Well in Wales, and the miraculous grotto at Lourdes; and of the firm belief not yet entirely extinct, in many rustic remedies, such as the removal of children's ailments by 'in-muring a live shrew in a cleft ash tree.'—*See* TOGRAPHY: F. Podmore, *Mesmerism and Christian Science*; G. B. Cutten, *Three Thousand Years of Mental Healing*.

**Fakirs** (fā-kēr'; literally 'poor men'), a kind of fanatic met with chiefly in India and the neighbouring countries, who retire from the world and give themselves up to contemplation. They are properly of the Mohammedan religion, but the term is often used for a mendicant of any faith. They are found both living in communities and solitary. The wandering fakirs gain the veneration of the lower classes by absurd penances and self-mutilations.

**Falaise** (fā-lāz), a town, France, department of Calvados, picturesquely situated on a rocky precipice (Fr. *falaise*) 23 miles S.W. of Caen. It contains several objects of interest, among others the ruined castle of the Dukes of Normandy, where William the Conqueror was born. Pop. 6850.

**Falashas**, inhabitants of Amhar, in Abyssinia, who claim descent from Jewish emigrants during the reign of Jereboam. See *Abyssania*.

**Falckenstein**, Edward Vogel von, a Prussian general, born in 1797, died in 1885. In 1813 he entered the Prussian army, distinguishing himself at the battles of Katzbach and Montmirail. In 1848 he served in the Holstein campaign, and he acted as colonel and chief of staff in the war

with Denmark in 1864. In the war of 1866 he commanded the Seventh Army Corps. On the outbreak of the Franco-German War in 1870 he was appointed military governor of the maritime provinces.

**Falcon** (fɛl'kɒn), a name of various birds of prey, members of the family Falconidae. The falcons proper (genus *Falco*), for strength, symmetry, and powers of flight are the most perfectly developed of the feathered race. They are distinguished by having the beak curved from the base, hooked at the point, the upper mandible with a notch or tooth on its cutting edge on either side, wings long and powerful, the second feather rather the longest, legs short and



Greenland Falcon (*Falco candicans*)

strong. The largest European falcons are the jerfalcon or gyrfalcon proper (*Falco gyrfalco*), a native of the Scandinavian Peninsula, and the Iceland falcon (*F. islandicus*); to which may be also added the Greenland falcon (*F. candicans*). Between these three species much confusion at one time prevailed, but they are now distinctly defined and described. These three Arctic falcons are often referred to the special genus *Hierofalco*. In the Greenland falcon the prevailing colour at all ages is white, in the Iceland falcon dark. The latter more nearly resembles the true gyrfalcon of Norway, which, however, is generally darker, rather smaller, but with a longer tail. The average length of any of these falcons is about 2 feet. The Greenland species used to be the most highly prized by falconers. Its food consists chiefly of ptarmigans, hares, and water-fowl. It is found over a wide range of northern territory. The peregrine falcon (*F. peregrinus*) is not so large as the jerfalcon, but more graceful in shape. It chiefly inhabits wild districts, and nestles among rocks. It preys on

grouse, partridges, ptarmigans, pigeons, rabbits, &c. Its flight is exceedingly swift, said to be as much as 150 miles an hour. The peregrine falcon was one of those most frequently used in falconry. Other British falcons are the hobby (*Hypotriorchis subbuteo*), formerly a great favourite for the chase of small game when falconry was in fashion; the merlin or stone-falcon (*Merula regulus*), small but swift and spirited; the kestrel or wind-hover (*Tinnunculus alaudarius*), one of the most common British falcons. The term falcon is by sportsmen restricted to the female, the male, which is smaller and less courageous, being called *siercel*, *tercel*, *tercelet*, or *falconet*. See *Falconry*.

**Falco'ne**, Anello, Italian painter born in 1600, studied along with Salvator Rosa under Spagnoletto. His paintings, consisting chiefly of battle-pieces, are masterpieces, but very rare. He died in 1665.

**Falconer** (fɛl'kɒn-er), Hugh, Scottish naturalist, born in 1808 died, 1865. After having graduated in arts at Aberdeen and medicine at Edinburgh, he went to India as a surgeon in 1830. Here he made valuable geological researches, and turned his attention to the introduction of tea cultivation. In 1837 he accompanied Barnes's second mission to Cabul. He visited England in 1843 and published an illustrated descriptive work entitled *Fauna Antiqua Sivalensis* (Ancient Fauna of the Sivalik Hills). He returned to India in 1848, where he had been appointed superintendent of the botanic gardens at Calcutta. In 1855 he returned to England, where he died.

**Falconer**, William, poet and writer on naval affairs, born at Edinburgh in 1782. He went to sea in the merchant service, was wrecked, and wrote a poem (*The Shipwreck*) descriptive of the incidents, published in 1762. He then entered the navy, and was rated as midshipman on board the *Royal George*. In 1760 he published a *Universe Marine Dictionary*. The same year he sailed for Bengal as purser of the *Aurora* frigate, which is believed to have foundered at sea.

**Falcon'idæ**, a family of diurnal birds of prey, in which the destructive powers are most perfectly developed. The family includes the different species of eagles as well as the hawks and falcons properly so called, and comprises the sub-families Cypactinæ (hammergeiers), Polyborinæ (carrion hawks), Accipitrinæ (hawks and harrriers), Aquilinæ (eagles), Buteoninæ (kites and buzzards), and Falconinæ (falcons).

**Falconry** (fɛl'kɒn-ri), also called *hawking*, the pursuit of game by means of trained hawks or falcons. Falconry is a sport of great antiquity in Asia, having been followed in China as early as 2000 B.C. In Europe it was, during the Middle Ages, the favourite amusement of princes

and nobles, and, as ladies could take part in it, became very general. Charlemagne passed laws in regard to falconry, while in Germany Henry the Fowler and the Emperor Frederick the Second were greatly addicted to it, and the latter wrote a work on the subject. In France it reached its greatest popularity under Francis I, whose grand falconer controlled an establishment of fifteen nobles and fifty falconers, at an annual cost of about 40,000 livres. In Britain the sport was practised before the Norman Conquest, but became still more popular after it, and till about 1650 enjoyed the prominence now held by fox-hunting. One of the most interesting of English works on the subject is that which forms the first part of the *Boke of St. Albans*, first printed in 1481.

George Turberville's *Booke of Faulconrie or Hawking* (1575), and Simon Latham's *The Falcon's Lure and Cure* (1633), may also be mentioned. Though the invention of firearms gradually superseded this amusement, it is not yet entirely extinct. The Duke of St. Albans is still hereditary grand falconer, and presents the king with a *cast* (or pair) of falcons on the day of his coronation. In Persia and other Eastern countries hawking is still in favour. The game hunted includes hares and rabbits, and, in the East, gazelles; with herons, wild geese, and many smaller birds. The training of a hawk is a work requiring great patience and skill, the natural wildness and intractable nature of the birds being very difficult to overcome. When a hawk suffers itself to be hooded and unhooded quietly, and will come to the trainer's hand to receive food, its education is considered far advanced, and the work of accustoming it to the *lure* may be proceeded with. The *lure* may be a piece of leather or wood, covered with the wings and feathers of a bird, and with a cord attached. The falcon is fed from it, and is recalled from flight by the falconer swinging the lure round his head with a peculiar cry. When the bird has been taught to obey the lure, it is next practised in the art of seizing its game, being initiated with prey fastened to a peg, and flown later at free game. When fully trained and being used for sport, the falcon is kept hooded until actually required to fly. Among the many technical terms con-



Falcon with Hood

nected with falconry may be mentioned that of *mew* (= moult), from which is derived the familiar name *mews*, originally places where hawks were kept while moulting. —BIBLIOGRAPHY: J. E. Harting, *Bibliotheca accipitraria*; Salvin and Broderick, *Falconry in the British Isles*; E. B. Michell, *The Art and Practice of Hawking*; H. Cox, C. Richardson, and G. Lascelles, *Coarse and Falconry* (The Badminton Library).

**Fald'stool** (O.H.Ger. *falden*, to fold, and *stol*, chair), a folding stool provided with a cushion for a person to kneel on during the performance of certain acts of devotion, especially a kind of stool placed at the south side of the altar, on which the Kings of England kneel at their coronation. The term is also given to a small desk at which the litany is enjoined to be sung or said.

**Faler'nian Wine**, an ancient wine of great repute amongst the Romans. It was made from the grapes grown on Mount Falerus in Campania. It was strong and generous, probably much resembling modern sherry.

**Falle'ro**, Marino, Doge of Venice, born in 1274, commanded the troops of the republic at the siege of Zara in Dalmatia, where he gained a brilliant victory over the King of Hungary. He succeeded Andrea Dandolo, 11th Oct., 1354, was accused of the design of overthrowing the republic and making himself sovereign of the state, and beheaded 17th April, 1355. The last scenes of his life are depicted in Byron's tragedy of *Marino Faliero*.

**Falk'kirk**, a parliamentary burgh of Scotland, in Stirlingshire, 21½ miles west by north of Edinburgh. The older portion of it is old-fashioned and irregularly built. There are several modern suburbs. In the town or its vicinity are the Carron Ironworks, the Falkirk Foundry, and others works, collieries, chemical-works, and distilleries. Falkirk is connected with the port of Grangemouth by a railway 3 miles long. The *Trysts of Falkirk*, held on Stenhousemuir, 3 miles to the N.N.W., are the largest cattle-fairs in Scotland. Falkirk is an old town, with many historical associations. In the neighbourhood was fought the battle of Falkirk in 1298 between Sir William Wallace and Edward I, the Scots, who were much inferior in numbers, being defeated. About 1 mile south-west from the town the Highlanders under Prince Charles defeated the Royal forces under General Hawley, 17th Jan., 1746. *Stirling and Falkirk Burghs* return one member to the House of Commons. Pop. of Falkirk, 33,812.

**Falkland** (fak'land), Lucius Cary, Viscount, an English man of letters, born about 1610. His father being then Lord-Deputy of Ireland, he was educated at Trinity College, Dublin. After passing a short time abroad, he devoted



himself to a life of retirement and literary studies, chiefly residing at his seat at Hurford, near Oxford, which he made a kind of academy for the learned men of the neighbouring universities. In 1639 he joined the expedition against Scotland; and in 1640, his peerage being Scottish, he was chosen member of the House of Commons for Newport, in the Isle of Wight. In the first instance he warmly supported the Parliament, but doubts of the ultimate objects of the parliamentary leaders caused him to modify his attitude; and in 1642 he accepted from Charles I the office of Secretary of State. When hostilities began, he embraced decidedly the cause of the king, though he desired peace rather than victory. He was slain at the battle of Newbury, 20th Sept., 1643. He left behind him a work entitled *A Discourse on the Infallibility of the Church of Rome*, several pamphlets and published speeches, and a few poems, but nothing that explains the universal praises bestowed on him by contemporaries.

Falkland (fak'land), an ancient royal burgh of Scotland, county of Fife, 21 miles north of Edinburgh. It was once the residence of the Scottish Kings, and possesses remains of an ancient palace and some curious old houses. There was formerly a castle here, in which David, eldest son of Robert III, was starved to death by order of his uncle the Duke of Albany, but no trace of it now remains. Falkland Palace was garrisoned by Rob Roy in 1715. Pop. 781.

Falkland Islands, an island group belonging to Great Britain, in the South Atlantic Ocean, about 300 miles east of the Straits of Magellan. They consist of two larger islands, East Falkland and West Falkland, containing respectively about 3000 and 2300 sq. miles, with a great number of smaller ones surrounding them; total area, 6500 sq. miles. They are hilly and boggy, entirely destitute of trees, but covered with a variety of grasses very nutritive for the sheep and cattle the rearing of which is the principal industry. Fish and sea-fowl abound. Wool, frozen meat, hides, and tallow are the chief exports; value in some years £600,000. The climate is equable and very healthy. The Falkland Islands were discovered by Davis on the 14th Aug., 1592. In 1710 a French vessel from St. Malo touched at them, and named them *Îles Malouines*. Settlements were afterwards formed on them by the French, Spaniards, and British alternately, but the British have ultimately retained possession of them. They now form a Crown colony which has a Governor and other officers appointed by the Government. Port Stanley, in East Falkland, is a thriving settlement, and has now a wireless station. During the European War the Germans suffered a naval defeat off the Falkland Islands in Dec., 1914. Pop. of the group, 3275.

Fallacy (Lat. *fallax*, apt to mislead), in logic, is when an argument is used as decisive of a particular issue, which in reality it does not decide. Properly a fallacy is a fault in the form of reasoning (see *Logic*), but the term is applied also to faults in the substance of the argument such as the *petitio principii*, or proving one proposition by assuming another which is identical with it; *ignoratio elenchi*, or mistaking the point at issue; *post hoc ergo propter hoc*, or arguing as if sequence were the same thing as cause and effect.

Fallières, Clément Armand, eighth President of the French Republic, born at Mézin, department of Lot-et-Garonne. The son of peasants, he studied law, was mayor of Nérac for some years, and in 1876 was elected to the Chamber of Deputies. Under-Secretary of State in the Ministry of the Interior in 1880, he became Minister of the Interior in 1882, Minister of Public Instruction from 1883 to 1885, and subsequently Minister of Justice and Public Instruction. He entered the Senate in 1890. In 1890 he became President of the Senate, and on 16th Jan., 1906, was elected President of the Republic. During his tenure of office Fallières displayed decided democratic principles and a tendency towards the Left. It was due to his initiative that a Ministry of Labour was formed in 1900. His term of office ended in Jan., 1913. Fallières was one of France's most democratic Presidents.

Fall of Bodies. All bodies on the earth, by virtue of the attraction of gravitation, tend to the centre of the earth. A ball held in the hand presses downward; if dropped, it descends vertically; if placed on an inclined plane, it rolls down, in doing which it presses the plane with a part of its weight. In the air bodies fall with unequal velocities, a piece of paper, for instance, more slowly than a ball of lead; and it was formerly thought that the velocity of the fall of bodies was in proportion to their weight. This error was attacked by Galileo, who, experimenting with balls of different substances which he dropped from the tower of Pisa, was led to the conclusion that the resistance of the air acting on different extents of surface was the cause of the unequal velocities, and that in a vacuum all bodies would fall with the same velocity. The truth of this last proposition was first demonstrated by Newton in his celebrated 'guinea-and-feather' experiment, where a guinea and feather are shown to fall side by side in the vacuum of the air-pump. This experiment proves that the force of gravitation in bodies is proportional to their inertia, that is, to their mass. The laws of falling bodies, that is of bodies falling freely in a straight line and through a distance short in comparison with that of the earth's centre, are the following:

1. When a body falls from rest it acquires velocity at the rate of about 32.2 feet per second every second. This number, which represents the acceleration due to the force of gravity, varies slightly with the locality, increasing from the equator to the poles, and diminishing as we recede from the surface of the earth. (See *Gravity*.) At the end of five seconds, therefore, the body would be found to be moving at the rate of  $5 \times 32.2$ , that is, 161 feet per second.

2. The space fallen through in the first second is half of 32.2, that is, 16.1 feet; and the space fallen through in any given time is found by multiplying the square of the number of seconds by 16.1. Thus in three seconds a body falls  $9 \times 16.1$  feet, or 144.9 feet.

3. The square of the velocity acquired by falling through any number of feet is found by multiplying twice that number by 32.2. Thus if a body falls 9 feet, the square of the velocity acquired is  $2 \times 32 \times 9$ , or 576 if we take 32 instead of 32.2; and taking the square root of 576, we find that a velocity of 24 feet is acquired in a fall of 9 feet.

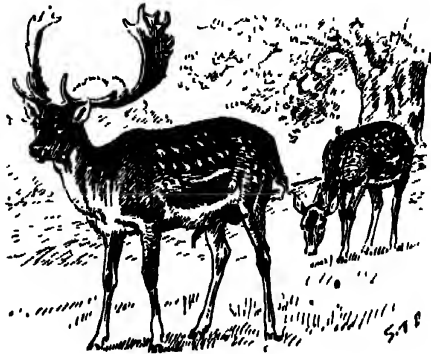
4. When a body is projected vertically upward with a given velocity, it continues to rise during a number of seconds found by dividing the number that expresses the velocity of projection by 32.2; and it rises to a height found by dividing the square of that number by  $2 \times 32.2$ , or 64.4. For a machine used in verifying the laws of falling bodies, see *Atwood*.

**Fall of Man**, a commonly received doctrine of Christianity, founded upon the historical narrative contained in the third chapter of the book of *Genesis*, together with the allusions to the same matter in other parts of Scripture. Adam, having eaten of the forbidden fruit, is said to have fallen; and the relation of mankind in general to this fall is stated by St. Paul in the words: "By one man's disobedience many were made sinners" (*Rom. v. 19*). Thus, in the fall of Adam, all men are held to have fallen and to have contracted 'original sin', alienating them from God and rendering them morally inadequate. The doctrine of the fall does not stand alone in Scripture. It is argued by some interpreters that in the original sentence pronounced on the transgressors there is contained the promise of a redemption, and that the whole scope of Scripture is directed to the development of this promise, and of the divine scheme of providence associated with it.

**Fallopian Tubes**, in anatomy, are two ducts each of which opens by one extremity into the womb, at either angle of the fundus, and terminates at the other end in an open trumpet-shaped mouth, which receives the ovum as it escapes from the ovary and transmits it to the womb. They are named after Fallopius or Fal-

lopio, an Italian anatomist of the sixteenth century, who first recognized their functions.

**Fallow Deer**, a European and Western Asiatic deer, the *Cervus dama*. It is smaller than the stag, of a brownish-bay colour, whitish beneath, on the insides of the limbs, and beneath the tail. The horns, which are peculiar to the male, are very different from those of the stag; they are not properly branched, but are broader towards the upper part, and divided into processes down the outside. A simple snag rises from the base of each, and a similar one at some distance from



Fallow Deer (*Cervus dama*)

the first. It was introduced at an early period into Britain, possibly by the Romans, and is kept in many English parks.

**Fallow Land**, ground that has been left uncultivated for a time, in order that it may recover itself from an exhausted state. Strictly speaking, fallow ground is left altogether without crops; but in agricultural usage strict fallow is not always adopted, and the term fallow is applied to various modes of treatment, of which at least three distinct varieties are recognized: *bare fallow*, *bastard fallow*, and *green-crop fallow*. Bare fallow is that in which the land remains completely bare for a whole year; in bastard fallow it is ploughed up and worked after the removal of a spring or summer crop, preparatory to the sowing of a root or forage crop, to occupy the ground during autumn or winter; in green-crop fallow the land is sown with a root-crop, such as turnips or potatoes, placed in rows far enough apart to admit of the intermediate spaces being stirred, pulverized, and cleaned, during its growth, by horse or hand implements.

**Fall River**, a city and port, Bristol County, Massachusetts, United States, on an arm of Narraganset Bay, on Taunton River, 58 miles s.s.w. of Boston. It is at the head of deep-water navigation, and the terminus of a line of

steamers from New York. It contains several handsome streets, and has extensive cotton, woollen, and calico-printing factories, as well as ironworks. Pop. 120,828.

**Falmouth**, a seaport and municipal borough of England, in Cornwall, 250 miles w.s.w. of London. There is a good harbour there, with a fine godstead affording excellent refuge for shipping. Falmouth was at one time an important packet station, but is now chiefly a port of call, its principal trade being in supplies and stores for shipping. Falmouth anc. 'nryn together give name to a parliamentary division of the county, returning one member to Parliament. Pop. 13,318.

**False Imprisonment**, the unlawful imprisonment or detention of any person. Every confinement of the person is imprisonment, whether in a common prison or a private house, or even by forcibly detaining one in the streets or highways. The law punishes false imprisonment as a crime, besides giving reparation to the party injured, through an action of trespass.

**False Personation** (English law). All forms of false personation, for the purpose of obtaining the property of others, are made penal by express statute. To personate the owner of any share, stock, or annuity, &c., is felony, and renders the offender liable to penal servitude for life, or to a modified term of penal servitude or imprisonment. The false personation of voters at an election is a misdemeanour punishable with imprisonment and hard labour, for a term not exceeding two years.

**Falsetto** (It.) applies, in singing, to the notes above the natural compass of the voice. It is also called the *head* or *throat* voice, in contradistinction to the *chest* voice, which is the natural one. The falsetto voice is produced by tightening the ligaments of the glottis.

**False Weights and Measures**. The using of false weights and measures is an offence at law punishable by fine. By various British statutes standards are provided for weights and for measures of capacity or dimension, and all contracts of sale, &c., are referred to such standards unless there is a special agreement to the contrary. See *Weights and Measures*.

**Fal'ster**, an island belonging to Denmark, situated at the entrance of the Baltic, east of Laland, from which it is separated only by a narrow strait; flat, well watered, and wooded; productive in grain, pulse, potatoes, and, above all, fruit; area, 183 sq. miles. The principal town is Nykjøbing. Pop. 37,460.

**Falun**, or **Fahlun** (fa'lun), a town of Sweden, on Lake Runn, 130 miles north-west of Stockholm. It has an excellent mining-school, museums, and mineralogical collections. Within the town boundary is the famous Falun copper-

mine, formerly the richest in Sweden, and worked for 500 years. Pop. 11,906.

**Fama Clamo'sa** ('a clamant report'), in the ecclesiastical law of Scotland, is a public report imputing immoral conduct to a clergyman, licentiate, or office-bearer of the Church. When the fama has become so notorious that it cannot be overlooked, the presbytery, after due inquiry, and if no particular party comes forward to institute a process, usually appear as accusers themselves.

**Famagos'ta**, or **Famagusta**, a seaport on the east coast of Cyprus. It is of remote antiquity, was an important place during the Middle Ages under the Lusignan kings of Cyprus and the Venetians, but, after being captured by the Turks in 1571, it declined. It has improved under the British, and has got a new harbour. Pop. 5327.

**Famatina**, a district and mountain range in the Argentine Republic, province of La Rioja, rich in copper; highest summit, the Nevada de Famatina, 19,738 feet high.

**Familiar Spirits**, demons or evil spirits supposed to be continually within call and at the service of their masters, sometimes under an assumed shape, sometimes attached to a magical ring, or the like, sometimes compelled by magic skill, and sometimes doing voluntary service. We find traces of this belief in all ages and countries, under various forms.

**Family**, in zoological classification, a group of species more comprehensive than a genus and less so than an order, a family usually containing a number of genera, while an order contains so many families. Family names usually terminate in -ide (after Latin patronymics, such as *Æælder*, sons or descendants of *Ææcus*). In botany it is sometimes used as a synonym of natural order.

**Family Compact**, the name given to an alliance organized by the Duc de Choiseul, first minister of Louis XV, between the various members of the Bourbon family, then sovereigns of France, Spain, the Two Sicilies, Parma, and Piacenza, mutually to guarantee each other's possessions. It was signed 15th Aug., 1761, and entailed on Spain a war with England.

**Famine**, an extreme scarcity of food affecting considerable numbers of people at the same time. Its causes are either natural, such as crop failures due to disease or to excessive or deficient rainfall, the effect of these being aggravated when the crop concerned is one on which the population mainly depends; or political and economic, such as war, or defects in the organization of production and distribution. In the Early and Middle Ages famines were frequent; but the rapidity of modern communication and transport made famines rare in Europe, until the conditions caused by the Great War produced

great scarcity in Central Europe. In Ireland the years 1814, 1816, 1822, 1831, 1840 were marked by failure of the potato crop, and in the last-mentioned year the dearth was so great that £10,000,000 were voted by Parliament for relief of the sufferers. India has been the seat of many great famines, which recur at more or less regular intervals; but of late the British officials have been successful in organizing preventive and relief measures, such as improvement in railways and irrigation, the multiplication of industries, and the institution of a famine insurance grant. Amongst the more recent famines are that in North-West India (1837-8), in which above 800,000 perished; that in Bengal and Orissa (1865-6), when about a million perished; that in Bombay, Madras, Mysore (1877); that of 1896-7; and that of 1900 in Bombay, Punjab, &c., perhaps the most serious on record, when the Government spent £10,000,000 in relief. In China a great famine took place in 1877-8, in which over 9 millions are said to have perished; another took place in 1888-9, owing to the overflow of the Yellow River.

**Fan**, the name of various instruments for exciting a current of air by the agitation of a broad surface. (1) An instrument made of wood or ivory, feathers, thin skin, paper, variously constructed and mounted, and used by ladies to agitate the air and cool the face. As an article of luxury the fan was well known to the Greeks and Romans. Fans are said to have been introduced into England from Italy in the reign of Henry VIII, and Queen Elizabeth was very fond of them. There is a collection of fans at the Victoria and Albert Museum, London. (2) Any contrivance of vanes or flat discs revolving for the aid of machinery, as for winnowing grain or cooling fluids, urging combustion, or assisting ventilation, is also so called.

**Fanariots**, or **Phanariots**, the inhabitants of the Greek quarter, or Phanar, in Constantinople, particularly the noble Greek families resident there since the times of the Byzantine emperors. The dragoman or interpreter of the Porte and other high officials used to be taken from their number. They have now mostly lost their influence at Constantinople, and have in many cases transferred themselves to Athens.

**Fanat'icism**, a term applied more particularly to the extravagance manifested in religious matters by those who allow themselves to be hurried away by their fancy and feelings, to the adoption not only of wild enthusiastic views, but also of inordinate and not infrequently persecuting measures. By an extension of the term it is also sometimes applied to other forms of extravagance.

**Fancy**, a term approaching imagination in meaning. In its general acceptation it refers

both to the forms of the imagination and to the mental faculty which produces them; but it is used frequently for the lighter or more fantastic forms of the imagination, and for the active play of that faculty which produces them. See *Imagination*.

**Faneull Hall** (fan'ū-il), a public building in Boston, famous as the place where stirring speeches were made at the outbreak of the war for American independence. It was built between 1740 and 1742 by a Huguenot merchant named Peter Faneuil.

**Fanfare** (Sp. *fanfarria*, brag), a short, lively, loud, and warlike piece of music, composed for trumpets and kettle-drums. Also small, lively pieces performed on hunting-horns, in the chase.

**Fan-foot**, a name given to a North African lizard of the genus *Ptyodactylus* (*P. lobatus*), one of the geckoes, much dreaded in Egypt for its supposed venomous properties.

**Fanning Island**, a coral island in the centre of Polynesia, lat. 3° 51' N., long. 159° 22' W. Since 1888 it belongs to Britain, is a landing-place of the Canada-Australia cable, and the stretch from this to Vancouver, 3458 miles, is the longest in the world. The island was discovered by Edmund Fanning in 1798. Area, 15 sq. miles; pop. about 200. It forms one of a small group sometimes called Fanning Islands.

**Fano**, a seaport of Italy, on the Adriatic, province of Pesaro e Urbino, 29 miles north-west of Ancona. It is a handsome town, and has a triumphal arch erected to Augustus, and other antiquities. Pop. (commune), 25,000.

**Fan-palm**, a name sometimes given to the talipot palm or *Corypha umbraculifera*, a native of Ceylon and Malabar. See *Talipot Palm*.

**Fans**, an African race of people inhabiting the region of the west coast about the Gaboon River and the Ogoway. They are an energetic race, skilled in various arts, and are rapidly increasing in numbers (about 300,000). They are cannibals, but contact with Europeans is leading them to give up the practice.

**Fanshawe**, Sir Richard, an English diplomatist, poet, and translator, born in 1608, died at Madrid in 1666. He studied at Cambridge, was secretary of the English Embassy at Madrid, and took the Royal side on the outbreak of the Civil War in 1641. He was made a baronet in 1650, was taken prisoner at Worcester, but permitted to go at large on bail. After the Restoration he was employed on several diplomatic missions, and in 1664, as Ambassador at Madrid, negotiated a peace between England, Spain, and Portugal. His poetical abilities were above mediocrity, as is evinced by his translations of the *Lusiads* of Camoens, the *Pastor Fido* of Gnarini, the *Odes* of Horace, and the fourth book of the *Æneid*.

Fan-tail, a variety of the domestic pigeon, so called from the fan-like shape of their tails. Also a name applied to certain birds (species of



Fan-tail Pigeon

*Rhipidura*) of the fly-catcher family, native to India, Australia, and New Zealand.

Fantees, a people of West Africa inhabiting the coast district of the Gold Coast Colony, between the Ashantis and the sea. They were at one time the most numerous and powerful people situated immediately on the Gold Coast seaboard; but their power was almost entirely broken after 1811 by repeated invasions of the Ashantis, and they have since lived under British protection. They are engaged in producing fruits, maize, and palm-wine.

Fan-tracery, in architecture, a borate geometrical carved work, which spreads over the



Fan-tracery Vaulting, Gloucester Cathedral

surface of a vaulting, rising from a corbel and diverging like the folds of a fan. Fan-tracery vaulting is much used in the Perpendicular style,

in which the vault is covered by ribs and veins of tracery, of which all the principal lines diverge from a point, as in Henry VII's chapel, Westminster Abbey.

Farad, the practical unit of capacity for electricity, in the electromagnetic system of units. The capacity of a conductor or condenser whose potential is raised by one volt when given a charge of one coulomb. This unit is too large for most purposes, and capacities are usually expressed in microfarads (q.v.).

Faraday, Michael, one of the greatest of English chemists and physicists, was born in humble circumstances at Newington Butts, near London, 22nd Sept., 1791, died 25th Aug., 1867. Early in life he was apprenticed to a bookbinder in London, but occupied himself in his leisure hours with electrical and other scientific experiments. Having been taken by a friend to Sir Humphry Davy's lectures, he attended the course, and became so interested that he decided to abandon his trade. With this end he sent his notes of the lectures to Sir Humphry Davy, who was so struck with the great ability they showed that he appointed him his assistant at the Royal Institution. In 1829 he became lecturer at Royal Military Academy at Woolwich and in 1833 he was appointed to the newly established chair of chemistry at the Royal Institution. It was while in this office that he made most of his great electrical discoveries. His communications to the *Philosophical Transactions* were published separately in three volumes (1839, 1844, 1855). In 1832 he received the honorary degree of D.C.L. from Oxford, and was made an honorary member of the Academy Berlin. In 1835 he received a pension of £300 a year from Lord Melbourne. As an experimentalist Faraday was considered the very first of his time. As a popular lecturer he was equally distinguished, and used to draw crowds to the Friday evening lecture at the Royal Institution. Amongst his published works we may mention the following: *Researches in Electricity* (1831-55), *Lectures on Non-metallic Elements* (1853), *Lectures on the Forces of Matter* (1860), *Lectures on the Chemical History of a Candle* (1861). BIOGRAPHY: J. Tyndall, *Faraday as a Discoverer*; S. P. Thompson, *Michael Faraday: his Life and Work*.

Faradization, or Faradism, the medical application of the induced currents which Faraday discovered in 1831.

Farallo'nes, a group of small islands in the Pacific, about 30 miles from the entrance to the Bay of San Francisco.

Faran'dola, an exciting dance popular amongst the peasants of the south of France and the neighbouring part of Italy. The men and women, placed alternately and facing dif-

ferent ways, form a long line winding out and in with a waving motion.

**Farce**, a subdivision of comedy, characterized chiefly by exaggeration and lack of rational character drawing. Farce stands in the same relationship to comedy as melodrama does to tragedy. Many farces commence with an impossible postulate, such as *The Comedy of Errors*. Jonson's *Silent Woman* is one of the best English farces. Gilbert's *Engaged* and *Fogarty's Paddy* are notable modern examples.

**Farcy**, a disease to which horses are liable, intimately connected with glanders, the two diseases generally running into each other. It is supposed to be a disease of the absorbents of the skin, and its first indication is generally the appearance of little tumours called farcy buds on the face, neck, or inside of the thigh. By an order in Council animals affected with farcy must be destroyed.

**Fardel-bound**, a term applied to cattle and sheep affected with a disease caused by the retention of food in the napeplies or third stomach, between the numerous pluits of which it is firmly impacted. Over-ripe clover, vetches, or rye-grass are liable to produce the disease.

**Fareham**, a town of England, in Hampshire, at the north-west extremity of Portsmouth harbour, giving name to a parliamentary division of the county. It has building-yards, potteries, and brickworks, and a considerable trade. Pop. 10,000.

**Farel**, Guillaume, one of the earliest and most active of the Swiss reformers, was born in 1489 in Dunpliny, died in 1505. At an early period he was led by his intercourse with the Waldenses to adopt similar views. After preaching in various parts of Switzerland, he came to Geneva, where he was so successful at the religious conferences of 1534 and 1535 that the Council formally embraced the Reformation. He was instrumental, also, in persuading Calvin to take up his residence in Geneva. At attempt on the part of the two reformers to enforce too severe ecclesiastical discipline was the cause of their having to leave the city in 1538. Farel took up his residence at Neuchâtel, where he died.

**Fargo**, a town of N. Dakota, United States, on the Red River of the North and the N. Pacific Railroad. Pop. 14,330.

**Faria y Sousa**, Manuel de, Portuguese historian and poet, born 1590, of an ancient and illustrious family, died about 1640. Among his writings are: *Discursos Morales y Politicos*, *Epitome de las Historias Portuguesas*; *Comentarios sobre la Lusitana*; and a collection of poems.

**Faribault**, a town of Minnesota, United States, 53 miles south of St. Paul's. Here are the State asylum for the deaf, dumb, and blind, and an episcopal divinity college. Pop. 9000.

**Faridpur** (fa-réd-por'), a district of India, in Eastern Bengal; area, 2267 sq. miles; pop. 1,037,650. Chief town, Faridpur, on the Mará Padmá. Pop. 11,000.

**Farina**, a term given to a soft, tasteless, and commonly white powder, obtained by trituration of the seeds of cereal and leguminous plants, and of some roots, as the potato. It consists of gluten, starch, and mucilage.

**Farinelli**, Carlo, an Italian singer, born at Naples in 1705, died in 1782. His true name was Carlo Broschi, and to develop his vocal powers he was made a eunuch. He sang in Vienna, Paris, and London with the greatest success. On visiting Spain, where he intended only a brief sojourn, he found King Philip V plunged in a profound melancholy. He succeeded in rousing him from it by the powers of his voice, and became his prime favourite and political adviser. But the penalty of his advancement was that for ten years he had to sing every night to his royal master the same six airs. On his return to Italy, in 1762, he found himself almost forgotten, but continued to exercise a splendid hospitality in his country house, near Bologna.

**Farini**, Luigi Carlo, an Italian statesman and author, born in 1812, died 1st Aug., 1866. He studied medicine at Bologna, and practised as a physician. He became known as a nationalist and patriot in the political movements of 1841, had to leave the country for a time, but returned and was made a member of the Reform Ministry at Rome during the disturbances of 1848. Disapproving equally the views of the old Conservative and the extreme Republican party, he went to Piedmont, where he was elected a Deputy, and fought with great energy both in pamphlets and in Parliament on behalf of Cavour and the Piedmontese Constitutionists. After the peace of Villafranca, he was chosen dictator of the duchies of Parma and Modena, and was mainly instrumental in inducing them to unite with the Piedmontese monarchy. His *History of the Papal States from 1814 to 1850* is well known. In 1862 he became President of the Ministry, but lost his reason in 1863.

**Farmers-general** (Fr. *Fermiers généraux*), private contractors, to whom under the old French monarchy was let out the collection of various branches of the revenue, poll-tax, duties on salt and tobacco, and customs. These contractors made enormous profits on the farming of the public revenues. A revenue collected in this way not only imposed a much heavier burden on the people, but the merciless rigour of irresponsible and uncontrolled exactors subjected them to hardships and indignities to which they could not submit without degradation. In 1790 the system was suppressed by the Constituent

Assembly, and many of the farmers-general were sent to the guillotine by the Revolutionary Tribunal.

**Farne**, or **Ferne Islands**, a group of seventeen islets, England, separated from the coast of Northumberland by a channel about 1½ miles wide. They have been the scene of some disastrous shipwrecks, including that of the *Forfarshire* in 1838. (See *Darling, Grace*.) There are two lighthouses. Pop. 15.

**Farnese** (far-nā'ze), an illustrious family of Italy, whose descent may be traced from about the middle of the thirteenth century, and which gave to the Church and the Republic of Florence many eminent names, amongst which the following may be mentioned: Pietro Farnese (died 1363), a general of the Florentines in the war against Pisa; Alessandro, who became Pope as Paul III (†534-40), and whose gifts to his natural son Pier Luigi of the duchies of Parma and Piacenza laid the foundation of the wealth and greatness of the family; Ottavio (1520-85), son and successor of Pier Luigi, spent a long and peaceful reign in promoting the happiness of his subjects. Alessandro (1540-92), elder son of Ottavio, became famous as a most successful general of the Spaniards in the wars with the Netherlands and France. Ranuzio (1569-1622), son of Ottavio, was a gloomy and suspicious tyrant. The line became extinct with Antonio in 1751. The name of the Farnese is associated with several famous buildings and works of art. The *Farnese Palace*, at Rome, was built for Pope Paul III, while he was cardinal, by Sangallo and Michel Angelo. It now belongs to France, and is occupied by the French Embassy. Its sculpture gallery was formerly very celebrated, but the best pieces have been removed to Naples, including the following: the *Farnese Bull*, a celebrated ancient sculpture representing the punishment of Dirce, discovered in 1546 in the Baths of Caracalla at Rome; *Farnese Hercules*, a celebrated ancient statue of Hercules by Glycon, found in the Baths of Caracalla in 1540; *Farnese Flora*, a colossal statue of great merit, found in the Baths of Caracalla; *Farnese Cup*, a unique onyx cup, highly ornamented with figures in relief.

**Farnham**, a town of England, county of Surrey, 3 miles s.w. of Aldershot; a well-built place. North of the town is Farnham Castle, the residence of the Bishops of Winchester. The staple trade is in hops. Farnham was the home of Swift's 'Stella' (Hester Johnson). Pop. 12,133.

**Farnworth**, a manufacturing and mining town of Lancashire, England, 3 miles from Bolton. Pop. (urban district), 27,001.

**Faro**, a seaport of Portugal, province of Algarve, 62 miles s.e. of Cape St. Vincent. It is surrounded by Moorish walls, and has a con-

venient harbour. Its trade is considerable. Pop. 12,680.

**Faro**, a promontory forming the north-east point of Sicily at the entrance to the Strait of Messina. The point is strongly fortified, and on it there is a lighthouse over 200 years old.

**Faroe Islands** (fā'rō; Dan. *Færder*, 'Sheep Islands'), a group of islands in the North Atlantic, lying between Iceland and Shetland. They belong to Denmark, and are twenty-one in number, of which seventeen are inhabited. The islands generally present steep and lofty precipices to the sea. Barley is the only cereal that comes to maturity; turnips and potatoes thrive well. There is no wood, but plenty of excellent turf, and also coal. The inhabitants are chiefly engaged in fishing and the rearing of sheep. Thorshavn, in Stromo, the largest island, is the seat of government. Pop. 18,000.

**Farquhar** (far'kar), George, Irish playwright, was born in Londonderry in 1677, and died in 1707. He was for a short time at Trinity College, Dublin, but was, according to one account, sent down for making a profane though clever joke on the miracle of walking on the sea. He became an actor, but left the stage after inadvertently injuring a fellow-actor, owing to his forgetting to substitute a stage-sword for the genuine article. He produced his first comedy, *Love and a Bottle*, in 1698. It is a lively and amusing comedy, and was well received. *The Constant Couple* (1690) was also successful, as was its sequel *Sir Harry Wildair*. His other best-known plays are *The Recruiting Officer* (1700), and his masterpiece *The Beaux' Stratagem* (1707), written when he knew that death was fast approaching him. Farquhar was in dire poverty most of his life; he had a commission in the army for a while, but gave it up owing to some false hopes of promotion held out by the Duke of Ormond. He increased his embarrassments by marrying in 1703 a penniless woman who had fallen in love with his appearance, and pretended to be an heiress. Although he lived and died in great distress, his gaiety never flagged; and *The Beaux' Stratagem* is one of the most mirthful comedies of the time.

Farquhar was a great playwright, and not much of a literary man. His comedies are all good acting comedies. He had been an actor himself, and so was much more closely in touch with the stage than the aristocratic Congreve. Farquhar stands above his contemporaries by reason of his realism. He did not go to other dramatists for his characters, but went straight to life. Indeed, in several cases his plays seem to have been in part autobiographical; the burlesque was the hero of the story. His plots are well constructed, especially his later ones. His characters are most of them genial rogues, and while



he is no Puritan his morality compares very favourably with the cynical indecency of his contemporaries. His influence upon Fielding, and therefore upon the rise and development of the English novel, was great, as he introduced a return to real models, and eschewed artificiality. Personally Farquhar was a most lovable man, and he appears to have lived and died a very gallant gentleman.

**Far'ragut**, David Glascoe, admiral of the United States, born in 1801, died 18th Aug., 1870. He entered the navy as midshipman at the age of eleven, was promoted to a lieutenancy in 1821, and was actively engaged in his profession up till 1851, when he was appointed assistant inspector of ordnance. In 1853 he received a commission as captain. In 1861 he was appointed to command the expedition against New Orleans, undertaken on the formation of the Confederacy, and sailed in January of the following year. New Orleans surrendered to the combined attack of the land and naval forces on 28th April, and Farragut proceeded to Vicksburg, which he attacked unsuccessfully. In consequence of his success at New Orleans he was promoted to the rank of vice-admiral, and placed in command of the blockading squadron of the Gulf of Mexico. In Aug., 1864, he attacked the Confederate fleet in the Bay of Mobile, and forced it to surrender, thus making the fall of Mobile merely a question of time. After this exploit he was made admiral, a grade which had not hitherto existed in the United States navy.

**Far'rant**, Richard, one of the earliest English composers of music. Very little is known of his history. He was a gentleman of the Chapel Royal in 1564, and subsequently organist and choir-master. He is supposed to have died about 1580. His music, which is ecclesiastical, is distinguished by purity, simplicity, tenderness, and elevation. The anthems *Call to Remembrance*, and *Hide not Thou Thy Face*, composed by him, are well known.

**Farrar**, Frederic William, English divine, son of a clergyman, born in Rumbay, 7th Aug., 1831, died 22nd March, 1903. He graduated at Cambridge, 1854, was assistant master at Harrow in 1855, headmaster of Marlborough College in 1871, Archdeacon of Westminster, 1883, and Dean of Canterbury, 1893. He wrote various popular theological works and works of fiction, and was Bampton Lecturer in 1885. Among his principal works are: *The Life of Christ* (1874), *Life of St. Paul* (1879), *The Early Days of Christianity* (1882), *Lives of the Fathers* (1889), *Darkness and Dawn*.

**Fars**, or Farsistan, a maritime province in the south-west of Persia, abutting on the Persian Gulf. It is mountainous, but has many rich

and well-cultivated districts. The most important products are grain, fruit, wine, oil, cotton, tobacco, silk, cochineal, and attar of roses. The manufactures include woollen, silk, and cotton goods; and in these and other articles an active trade is carried on, chiefly with Hindustan. Pop. estimated at 1,700,000.

**Farsan**, two islands on the east side of the Red Sea on the coast of Yemen, called respectively Farsan Kebir and Farsan Segir.

**Farthingale**, or Fardingale, an article of ladies' attire worn in the days of Queen Elizabeth, and closely resembling the more recent



Farthingale

crinoline. It was formed of circles of whalebone hoops, and protruded more at the waist than the Victorian crinoline.

**Farukhabad**, or Farrakhabad (*far-ak-a-bad'*), a city in Agra division, United Provinces of British India, 2 or 3 miles from the Ganges, a handsome, well-built town, with avenues of trees in many of its streets. Pop. 59,047.

**Fasces** (*fas'sez*), in Roman antiquities, a bundle of polished rods, in the middle of which was an axe, carried by lictors before the superior magistrates. The number of fasces and lictors varied with the dignity of the magistrate. In the city the axe was laid aside.

**Fas'cia** (Lat., a bandage), in anatomy, signifies any thin sheet of fibrous tissue, such, for example, as the covering which surrounds the muscles of the limbs and binds them in their places.

**Fascination** (Lat. *fascinare*, to charm), the exercise of an overpowering and paralyzing influence upon some animals attributed to certain snakes. Squirrels, mice, and the smaller birds are said to be the most subject to this power;

but the fact is far from clearly explained, and is not perhaps even sufficiently demonstrated. Most of the accounts agree in describing the animal fascinated as having a painful consciousness of its danger, and the power exercised over it, but to be unable to resist the desire to approach the fascinator. It is probable, however, that the real explanation of the phenomenon is to be found in the influence of the intense emotion of fear upon the muscles.

**Fascines** (fa-sēnz'), in field engineering, bundles of boughs or rods from 6 to 18 feet in length and usually 1 foot in diameter, used in raising batteries, strengthening parapets, or revetting slopes. The twigs are drawn tightly together by a cord, and bands are passed round them at the distance of 2 feet from each other. Very long thin ones are called *saucissons* or *buttery-saucisses*.

**Fasho'da**, a station in the Anglo-Egyptian Sudan, on the Bahr-el-Abiad or White Nile, 400 miles south of Khartoum, and about 70 miles north-east of the confluence of the Sobat with the Nile. In July, 1898, it was occupied by a French force under Colonel Marchand, but some months later was claimed by the British for Egypt. The affair threatened to involve the two countries in war, but ultimately the French evacuated the place, which was then formally occupied by Sudanese troops. It has been renamed Kodok.

**Fast-and-loose**, a cheating game sometimes played at fairs by gypsies, and also called 'prick the gutter'. A belt or strap is doubled and rolled up with the double in the middle of the coils; it is then laid on a board, and the dupe is asked to catch the double with a skewer, when the gambler takes the two ends and loses it or draws it away, so as always to keep the skewer outside the doubled end. The game is mentioned four times in Shakespeare, e.g. *Antony and Cleopatra*, iv, 12, 28.

**Fasti** (Lat.), among the Romans, registers of various kinds; as, *fasti sacri*, calendars of the year, giving the days for festivals or courts, being a sort of almanac.

**Fasting**, the partial or total abstinence of mankind and animals from the ordinary requisite supply of aliment, by which it is to be understood that quantity which is adapted to preserve them in a healthy and vigorous condition. It would appear that various warm-blooded animals are capable of sustaining total abstinence much longer than human beings. Cats and dogs have survived for several weeks without nourishment of any kind but it is probable that few human beings could survive such deprivation for more than a week. The use of water without solid food enables life to be sustained much longer than it could otherwise be.

**Fasts**, temporary abstentions from food, especially on religious grounds. Abstinence from food, accompanied by signs of humiliation and repentance or grief, is to be found more or less in almost all religions. Among the Jews fasts were numerous, and we find many instances of occasional fasting in the Old Testament. Herodotus says that the Egyptians prepared themselves by fasting for the celebration of the great festival of Isis. So in the Thesmophoria at Athens, and in the rites of Ceres at Rome, it was practised. The Church of Rome distinguishes between days of fasting and of abstinence. The former are: (1) the forty days of Lent; (2) the Ember days, being the Wednesday, Friday, and Saturday of the first week in Lent, of Whitsun week, of the third week in September, and of the third week in Advent; (3) the Wednesdays and Thursdays of the four weeks in Advent; (4) the vigils or eves of Whitsuntide, of the feasts of St. Peter and St. Paul, of the Assumption of the Virgin, of All Saints, and of Christmas Day. When any fasting day falls upon Sunday, it is observed on the Saturday before. The Greek Church observes four principal fasts: that of Lent, one beginning in the week after Whitsuntide, one for a fortnight before the Assumption, one forty days before Christmas. In the East, however, the strict idea of a fast is more preserved than in the West. The Church of England appoints the following fixed days for fasting and abstinence, between which no difference is made: (1) the forty days of Lent; (2) the Ember days at the four seasons; (3) the three Rogation days before Holy Thursday; (4) every Friday except Christmas Day. The Church, however, gives no directions concerning fasting. —BIBLIOGRAPHY: L. Duchesne, *Christian Worship*; J. Dowden, *The Church Year and Calendar*; article *Fasting* in Hastings' *Encyclopædia of Ethics and Religion*.

**Fat**, an oily concrete substance, a compound of carbon, hydrogen, and oxygen, deposited in the cells of the adipose or cellular membrane of animal bodies. In most parts of the body the fat lies immediately under the skin. Fat is of various degrees of consistence, as in tallow, lard, and oil. It is generally white or yellowish, with little smell or taste. It consists of esters of glycerine with fatty and other acids, and these are generally termed glycerides. The commonest of these are stearin, a waxy solid, palmitin, a softer solid, and olein, an oil. Fats are insoluble in water. When boiled with caustic alkalies, e.g. caustic soda, they are decomposed (saponified), yielding an alkali salt of the fatty acid (soap) and glycerine. The consistency of any natural fat depends on the proportions in which these three substances are present, e.g. mutton suet consists mainly of stearin, and olive

oil of olein. In the body fat serves as a packing, and helps to give roundness of contour. Being a bad conductor of heat, it is useful in retaining warmth, but its chief function is that of nutrition.

**Fa'talism**, the belief in fate, or an unchangeable destiny, to which everything is subject, uninfluenced by reason, and pre-established either by chance or the Creator. Fatalism existed among the Hebrews, Greeks, and Romans, and is still prevalent among Mohammedans. The fact that many events in man's life seemed to be inevitable gave rise to the belief in fatalism. Amongst notable historical examples of the belief in fate may be mentioned the old Greek conception of a fate which stood behind the gods themselves as a controlling power; the Mohammedan fatalism, which regards all things great and small as inexorably predetermined, so that no accident is possible. Fatalism is to be distinguished both from *determinism* and *predestination*.

**Fategarh** (*fat-e-gar'*), a town, United Provinces of India, on the Ganges, now municipally united with Farukhabad, the scene of a massacre of upwards of 200 Europeans during the Mutiny of 1857. Pop. 12,500.

**Fatehpur** (*fat-e-par'*), a town of India, in district of the same name, Allahabad division, United Provinces, 50 miles S.W. of Cawnpore. Pop. 16,030.—The district has an area of 1039 sq. miles, and a pop. of 680,400.

**Fatehpur Sikri**, a town of India, district of Agra, United Provinces. It was the favourite residence of the Emperor Akbar, who enclosed and fortified it. It now chiefly consists of a vast expanse of magnificent ruins enclosed by a high stone wall some 5 miles in circuit. Pop. 6132.

**Fates** (in Lat. *Parce*, in Gr. *Moirai*), in Greek and Latin mythology, the inexorable sisters who spin the thread of human life. The appellation *Clotho* (the spinner) was probably at first common to them all among the Greeks. As they were three in number, and poetry endeavoured to designate them more precisely, *Clotho* became a proper name, as did also *Atropos* and *Lachesis*. *Clotho* means she who spins (the thread of life); *Atropos* signifies unalterable fate; *Lachesis*, lot or chance; so that all three refer to the same subject from different points of view. They know and predict what is yet to happen. *Lachesis* is represented with a spindle, *Clotho* with the thread and *Atropos* with shears, with which she cuts it off. We find also in the northern mythology three beautiful virgins, the *Nornen*, who determine the fate of men. Their names are *Urd* (the past), *Furande* (the present), and *Skuld* (the future).

**Fatherlasher**, or **Bull-head**, a fish of the

genus *Cottus* (*Cottus bubalis*), from 8 to 10 inches in length. The head is large, and is furnished with several formidable spines. The fish is found on the rocky coasts of Britain, and near Newfoundland and Greenland. In the latter regions it attains a much larger size, and is a considerable article of food.

#### Fathers of the Church, The.

1. *The term 'Fathers'.*—This term, as used in the sense of spiritual parents of the Christian faith and life, appears to have become current in the fourth century. It was so used by Christian teachers, who cited as authoritative the great teachers and guides who were their predecessors. By the 'Fathers' they meant, specifically, the earlier writers who carried on the work of instruction which was begun by Peter and John and the rest of the Apostles. As employed nowadays, the term has a great fluidity of meaning. In the widest sense it signifies all ecclesiastical writers (i.e. all writers within the Christian Church who treat of matters of Christian belief and practice) belonging to the older post-Apostolic period. In the narrower, and more frequent sense it signifies only those ecclesiastical writers of the older post-Apostolic period who conform, more or less, to the Catholic tradition. As St. Vincent of Lérins lays it down, "Those alone should be named 'Fathers' who have been staunch in the communion and faith of the One Catholic Church, and have received ecclesiastical approbation as teachers".

2. *Fathers and Doctors.*—To such among the Fathers as were regarded as the most eminent the distinguishing title of 'Teachers' (*doctores*) was given. Thus in the Western Church Ambrose, Jerome, Augustine, and Gregory I were the four great Teachers or Doctors; while in the Eastern Church a similar position was assigned to Athanasius, Basil, Gregory of Nazianzus, and Chrysostom. But others also have been acknowledged as Doctors, as Hilary of Poitiers, Cyril of Alexandria, John of Damascus, and our one English Father (born out of due season) the Venerable Bede—not to speak of the application of the term to some of the mediæval Schoolmen.

3. *The Patristic Period.*—While it is universally agreed that the Apostolic Age is succeeded by the Age of the Fathers, there is a difference of view as to when the Age of the Fathers terminates. Gregory I (the Great) is usually regarded as the last of the Latin or Western Fathers and the first of the Schoolmen, and John of Damascus as the last of the Greek or Eastern Fathers. But where the term 'Fathers' is broadly used to designate the older Church writers in general, the tendency is—and it is logically defensible—to extend the Patristic period far beyond the Age of the Great Fathers (325–451), and to include among the later Fathers

many mediæval writers. Thus the Abbé Migne, who in the middle of last century issued a monumental edition of the original Greek and Latin texts of the Fathers, carried the Latin Fathers as far as Innocent III in the beginning of the thirteenth century, and the Greek Fathers down to the Council of Florence and the fall of Constantinople in the middle of the fifteenth century.

1. *Division and Classification.*—The broadest division of the Fathers is according to locality, and is into Eastern and Western. To this the division according to language, into Greek and Latin, largely corresponds. But it is to be remembered that in the early Patristic Age, or before Tertullian, Latin was not used by ecclesiastical writers. It is also to be remembered that among the Eastern Fathers there were writers in Syriac, Armenian, and Coptic, as well as Greek.<sup>9</sup> Another broad and general division is into ante-Nicene, Nicene, and post-Nicene; which is according to the principle that the Council of Nicea (A.D. 325) marks the transition from a simple and unsystematized to a unified official testimony. But it is usual in Church history, while observing the aforesaid general divisions, to arrange the Fathers in certain historical groups, representing for the most part distinct schools of thought. There are however, great names that cannot be conveniently treated under any historical group, such names as Irenæus, Athanasius, Jerome, Leo the Great, and Gregory the Great. Keeping this in view, we might classify the Fathers in accordance with the following scheme: (1) the *Apostolic Fathers* (the best known of whom are Clement of Rome, Ignatius, and Polycarp), who received their title not only as being younger contemporaries and perhaps personal disciples of Apostles, but also for their nearness and faithfulness to the Apostolic tradition; (2) the *Greek Apologists* (the most notable of whom is Justin Martyr), who sought to defend Christian truth on rational and philosophical grounds against both Jew and pagan; (3) the *Alexandrines* (outstanding among whom are Clement and Origen), who greatly furthered the development of Christian theology in general, but whose names are specially associated with the allegorical and mystical type of Scriptural interpretation; (4) the *North African School* (to which Tertullian and Cyprian belong), who shaped Christian Latinity, as well as the theology and ecclesiastical polity of the West; (5) the *Cappadocians* (in which group the most prominent members are Basil, Gregory of Nazianzus, and Gregory of Nyssa), who caught up the theology of Athanasius, providing it with well-defined terms, and so laying broad the foundations of the Greek orthodoxy; (6) the *Antiochians* (among whom Chrysostom, Theodore of Mopsuestia, and Theodoret are the

greatest), who were opposed to the Alexandrian mysticism and held by the literal and historical mode of Scriptural interpretation; (7) the *Western Nicene Group* (counting in their number eminent teachers like Hilary of Poitiers and Ambrose), who followed the Alexandrians in their exegetical method, and in their dogmatic theology Athanasius and the Cappadocians; (8) the *School of Augustine*, in which the Western theological tradition set by Tertullian and Cyprian culminated; (9) the *School of Léris* (leading members of which are Hilary of Arles and Vincentius), which attempted to mitigate the extreme Augustinian doctrines of sin and grace.

5. *Value of Patristic Study.*—Among the Fathers are many great thinkers and writers (not to say orators, organizers, and statesmen) who should be studied for their own sake, and for the influence they have wielded. We would only indicate here some of the various uses of patristic study. (1) The *student of the Bible* turns to the Fathers, and especially the earlier of them, for light upon the problem of the true or original text of the Bible—although very few of the Fathers knew the Hebrew tongue, and only Origen and Jerome can throw direct light upon the Old Testament text. To the Fathers also, especially great exegetes like Origen, Chrysostom, Jerome, and Augustine, the Biblical student turns for light upon the meaning of the sacred text, and for knowledge of the history of its interpretation. (2) The *student of Church history* finds first-hand material in the Fathers for the older post-Apostolic period. This material is supplied in the treatises and letters of the Fathers generally. But patristic writers from Eusebius downwards furnish us also with formal histories of the Church of both a general and special character. Patristic histories, as indeed all histories, are to be used with critical caution. And not only do the Fathers inform us as to the course of events; we are dependent upon them for our knowledge of the development of creed and liturgy, ritual and order, and other Christian institutions. (3) The *student of ecclesiastical dogma and Christian theology in general* cannot dispense with the study of the Fathers. The patristic was the formative and, in a sense, conclusive period of Christian theology. In the ancient Greek theology the idea of God was developed, and in the so-called Nicene Creed and the Chalcedonian Definition the doctrines of the Trinity and the Person of Christ respectively received their final Greek dogmatic expression. Landmarks in the history of this dogmatic development are the names of Origen, Athanasius, Basil and the Gregories, Theodore of Mopsuestia, and Leo the Great. In the ancient Latin theology, in accordance with the more practical genius of the Westerns, the doctrine

of man was developed, and of sin and grace. With this anthropological or soteriological, as distinguished from the other more strictly theological movement, the names of Tertullian, Cyprian, and Augustine are principally associated. It was left to the mediæval theologians to work out the doctrine of the Work of Christ. —BIBLIOGRAPHY: F. W. Farrar, *Lives of the Fathers*; E. Leigh-Bennett, *Handbook of the Early Christian Fathers*; S.P.C.K., *The Fathers for English Readers* (a series of biographies); also *Early Church Classics* (a series of translations); H. B. Swete, *Patristic Study* (1902; an excellent introduction to the field of patristic learning, with useful bibliographies); W. Bright, *The Age of the Fathers*.

**Fat'imate Dynasty**, a line of caliphs claiming descent from Fatma, the favourite daughter of Mohammed, and of Ali her cousin, to whom she was married. In the year 909 Abu-Mohammed Obeidallah, giving himself out as the grandson of Fatma, endeavoured to pass himself off as the Mahdi or Messiah predicted by the *Koran*. Denounced as an impostor by the reigning Caliph of Bagdad, he fled into Egypt, became Caliph of Tunis, and soon conquered all Northern Africa from the Straits of Gibraltar to the borders of Egypt. His son wrested Egypt from the Abbasides in 970 and founded Cairo. The Fatimite dynasty was extinguished in 1171, on the death of Al Adid, the fourteenth caliph, and a new line began with Saladin.

**Fatty Acids**, the homologues of formic and acetic acid; so called because the members first studied were obtained from fats and oils, e.g. butyric acid from butter, stearic acid from stearin, palmitic acid from palm-oil. These acids are present united with glycerol in the fats as glycerides, and are obtained from them by saponification with superheated steam or mineral acids, when the fatty acid is liberated, floats to the surface, and glycerol remains in solution. They are all monobasic acids; the lower members are colourless liquids, and the higher members from  $C_{12}H_{25}COOH$  upwards are colourless solids. The general formula for the series is  $C_nH_{2n+1}COOH$  (where  $n$  = the number of carbon atoms in the alkyl group).

**Fatty Degeneration**, an abnormal condition found in the tissues of the animal body, in which the healthy protoplasm is replaced by fatty granules. It is a sign of defective nutrition, and is common in old age, affecting the muscles, the heart, arteries, kidneys, &c. It is accompanied by great muscular flabbiness and want of energy, the sufferer looking at the same time fat and comparatively well.

**Fatty Tissue**, in anatomy, the adipose tissue, a tissue composed of minute cells or vesicles, having no communication with each other, but

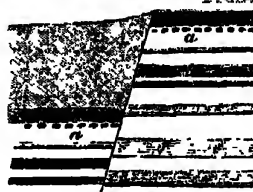
lying side by side in the meshes of the cellular tissue, which serves to hold them together, and through which also the blood-vessels find their way to them. In the cells of this tissue the animal matter called fat is deposited.

**Faubourg** (fô-bor; Lat. *foris*, outside, beyond, and *burgus*, borough), a suburb of French cities; the name is also given to districts now within the city but which were formerly suburbs.

**Faucigny** (fô-sê-nyê), a district of France, department of Haute Savoie, one of the loftiest districts of Europe, being partly traversed by the Peimine Alps.

**Fau'cit**, Helen, Lady Martin, was born in 1810, died in 1898. She was the daughter of Mrs. Faucit the actress, and made her debut at the Theatre Royal, Richmond, in 1833, as Juliet in *Romeo and Juliet*. She first appeared in London at Covent Garden as Julia in *The Hunchback*, in which she gained a decided success. One of the most important members of Macready's company during the Shakespearean revivals of 1837, she created the heroine's part in Lord Lytton's *Lady of Lyons*, *Money*, and *Richelieu*, and in Browning's *Stratford*, *Blot on the Scutcheon*, and *Colombe's Birthday*. She was married to Sir Theodore (then Mr.) Martin in 1851, after which she but rarely appeared on the stage except for charitable purposes. In 1879 she appeared as Beatrice at the opening of the Shakespeare Memorial Theatre at Stratford-on-Avon. Lady Martin wrote a volume *On Some of Shakespeare's Female Characters*.

**Fault**, in geology, a fracture of strata, accompanied by a sliding down or an upheaval of the



Fault in Geology

deposits on the one side of the fracture to a greater distance than the other. Faults are frequently recognizable in coal-beds, the miner coming unexpectedly upon an abrupt wall cutting off the seam. The angle this makes with the plane of the bed he is working usually indicates

whether he must look up or down for its continuation on the other side of the fracture; but *reversed faults* occur, in which the strata on one side have been pushed up the slope of the plane of fracture. In mines these faults often serve for natural drains. The cut shows at *a a* the change of position in strata caused by a fault. This is called the *throw*, and is measured vertically.

**Faun**, one of a kind of rural deities or demi-gods believed in among the Romans, inhabiting the forests and groves, and differing little from satyrs. Their form was principally human, but with a short goat's tail, pointed ears, and projecting horns; sometimes also with cloven feet. There are some famous antique statues of fauns, *The Dancing Faun* at the Uffizi in Florence (restored by Michel Angelo); *The Dancing Faun* at Naples; *The Faun (of Praeteste?)* at the Capitoline Museum, Rome; and *The Sleeping Faun*.

**Fauna** (from *faun*, q.v.), a collective word signifying all the animals of a certain region, and also the description of them, corresponding to the word *flora* in respect to plants.

**Faust**, or **Faustus**, Doctor John, a celebrated dealer in the black art, who lived in Germany, early in the sixteenth century. There is really a substratum of fact beneath the Faust legend; there actually was a charlatan of this name who lived in the sixteenth century. He seems to have been a pretentious and vicious egomaniac. A vast amount of legend, however, has gathered round his name in Germany. According to some accounts he was born in Suabia, others make him a native of Anhalt, others of Brandenburg. In his sixteenth year he went to Ingolstadt and studied theology, became in three years a *magister*, but abandoned theology, and began the study of medicine, astrology, and magic, in which he likewise instructed his familiar Johann Wagner, the son of a clergyman at Wasserburg. After Dr. Faust had spent a rich inheritance, he, according to tradition, made use of his power to conjure up spirits, and entered into a contract with the devil for twenty-four years. A spirit called *Mephistopheles* was given him as a servant, with whom he travelled about, enjoying life in all its forms, but the evil spirit finally carried him off. Even yet Dr. Faustus and his familiar Wagner play a conspicuous part in the puppet-shows of Germany, and the legend forms the basis of Goethe's well-known drama *Faust*, and furnishes the libretto for Gounod's famous opera of the same name. As early as 1590 Christopher Marlowe made the legend the subject of his masterpiece *Doctor Faustus*, the last scene of which is one of the most dramatic in all literature.—Cf. H. B. Cotterill, *The Faust-legend and Goethe's Faust*.

**Faustina**, the name of two Roman ladies: (1) *Annia Galeria Faustina* (died A.D. 141), the wife of the Emperor Antoninus Pius; and (2) her daughter, who was married to the Emperor Marcus Aurelius (died A.D. 175). Both were accused of dissolute conduct.

**Favart** (fa-vâr), Charles Simon, creator of the serio-comic opera in France, born 1710, died in 1792, the son of a pastry-cook. His poetical reputation rests principally on his numerous productions for the *opéra aux Italiens*, and the comic opera. He also wrote *Mémoires et correspondance littéraires* (1808). He was the director of a company of itinerant actors which followed Marshal Saxe into Flanders. His wife, Madame Favart, was a famous singer, comic actress, and dancer, and helped in the composition of her husband's plays.

**Faversham**, a seaport of England, county Kent, on a branch of the Swale, giving name to a parliamentary division of the county. It is a very ancient place, and has manufactures of brick, cement, and gunpowder. Faversham Creek is navigable up to the town for vessels of 200 tons. Pop. 10,870.

**Favre** (fâvr), Jules, a French politician, born 21st March, 1809, at Lyons, died in 1880. He studied law, and after distinguishing himself at the Lyons Bar came to Paris in 1833, where he became famous as a defender of political prisoners. On the outbreak of the revolution of 1848 he became secretary to Ledru-Rollin. He was a leader of the party of opposition to the President Louis Napoleon; and after the *coup d'état* (1851) he retired from political life for six years, till in 1858 his defence of Orsini for the attempt on the life of the emperor again brought him forward. From this time he again became an active leader of the Republican opposition to the emperor. On the fall of the empire he became Vice-President of the Government of National Defence and Minister of Foreign Affairs. As such he conducted the negotiations for peace with Prince Bismarck, and signed the Treaty of Paris at Frankfurt on 10th May, 1871. But though he showed great energy, and was very eloquent, his operations both in the matter of the armistice and the peace showed a lack of skill and judgment. He resigned his office in July, 1871.

**Favus** is a disease due to a fungus, and affects the hair, hair-follicles, and skin, usually of the scalp. It produces rounded cup-shaped crusts, and may lead to very extensive destruction of the hair. Cuts and mice are affected by the disease, and are frequently responsible for spreading it. The X-rays are the most effective treatment.

**Fawcett**, Henry, an English politician and economist, born at Salisbury in 1833, died 6th

Nov., 1884. He was educated at Cambridge, studied law for a while at the Middle Temple, but soon renounced it. In 1858, when out partridge shooting, he met with an accident which inflicted on him total blindness. Undiscouraged, however, by his deprivation, he gave his attention to economic studies. In 1863 he was elected to the chair of political economy at Cambridge. In 1865 he was elected member of Parliament for Brighton, which he represented till the general election of 1874, when he was elected for Hackney. He became Postmaster-General in the second Gladstone administration, and effected many reforms in his department. In 1883 he was made Lord Rector of Glasgow University. Amongst his principal writings are: *A Manual of Political Economy*, *Lectures on the Economic Position of the British Labourer*, and articles on Indian finances.

Fawcett, Millicent Garrett, wife of the preceding, born 1847, shared her husband's studies, and published: *Political Economy for Beginners*, *Some Eminent Women of Our Time*, *Life of Queen Victoria*, and *Five Famous French Women*. She is also known as a prominent advocate of all measures for the educational and political advancement of women, and wrote *Women's Suffrage* (1912).

Fayal (fi-al'), an island belonging to Portugal, one of the Azores. It is of a circular form, about 10 miles in diameter. The climate is good, and the air always mild and pure. The soil is very fertile, producing in abundance wheat, maize, flax, and almost all the fruits of Europe. It exports a great quantity of oranges and lemons. The chief place is Villa Horta or Orta. Pop. 22,385.

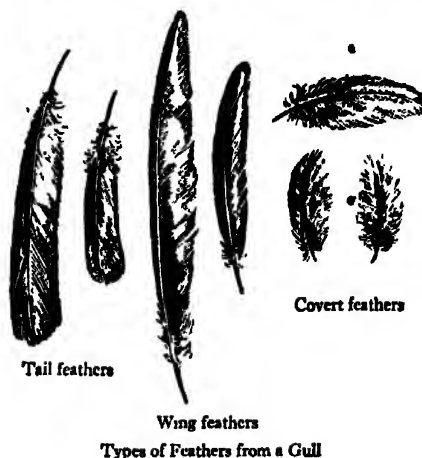
Fayoum (fa-yômr'), a province of Middle Egypt, a little to the west of the Nile, surrounded by the Libyan Desert; area about 670 sq. miles. The soil is alluvial, and, in the north, particularly fertile. Fayoum is irrigated by canals coming from the Canal of Joseph, and that from the Nile, and is one of the most fertile provinces of Egypt. Here lay the ancient Labyrinth and the artificial Lake Moeris. On the west lies Lake Birket-el-Kurun. The chief town, Medinet-el-Fayoum, is connected with Cairo by a railway. Pop. of province, 441,583.

**Feast of the Dedication of the Temple**, a Jewish feast instituted by Judas Maccabæus in 164 B.C. It lasted eight days, and was a time of general rejoicing, when the people—old and young—carrying palm branches, met together in their synagogues to hold services of thanksgiving and commemoration. Every house was illuminated, and even the temple at Jerusalem was lighted up. In certain of its observances it resembles the Feast of the Tabernacles. Some authorities think that Christmas was celebrated

in December by the ancient Church because that was the date of the Feast of Dedication. It is mentioned in *John*, x, 22.

**Feather-grass**, the popular name of *Stipa pennata*, a native of dry places in the south of Europe. The rigid leaves roll up in dry air like those of marram-grass; the awns are exceedingly long, feathered to the point, and hygroscopic, curling up spirally when dry, and uncurling when moistened; these movements of the awn serve to bury the fruit. *S. tenacissima* is the spartograss used in paper-making.

**Feathers**, the form which the dermal appendages assume in birds, agreeing in mode of development, but differing in form from hairs and scales. The feather consists of a stem-



horny, round, strong, and hollow in the lower part, called the *quill*, and in the upper part, called the *shaft*, filled with pith. On each side of the shaft is a web composed of a series of regularly arranged fibres called *barbs*. The barbs and shaft constitute the *vane*. On the edges of the barbs are set the *barbules*, which interlock with those of adjacent barbs, and thus give strength to the vane. Feathers are of four chief kinds. (1) *Quill feathers* of the wing (*remiges*) and tail (*rectrices*); the former are attached to the hand and forearm. (2) *Contour feathers*, which determine the external form and are attached to certain areas of the skin; those overlapping the quills are known as *wing-coverts* and *tail-coverts*. (3) Small soft *down feathers*. (4) *Hair-like feathers* (*filoplumes*). The plumage of birds is of characteristic colours, due either to pigments or physical structure (metallic feathers), and commonly having a protective function by harmonizing with the surroundings (especially in females), or, when of bright kind, playing a part in courtship (especially in males). The



feathers of birds are periodically changed, generally once, but in some species twice a year. This is called *moulting*. When feathers have reached their full growth they become dry, and only the tube, or the vascular substance which it contains, continues to absorb moisture or fat. When, therefore, part of a feather is cut off, it



Feather from the Back of an Argus Pheasant

does not grow out again; and a bird whose wings have been clipped remains in that condition till the next moulting season, when the old stumps are shed and new feathers grow out. If, however, the stumps are pulled out sooner (by which operation the bird suffers nothing), the feathers will be renewed in a few weeks or even days. The feather is a very strong formation, not readily damaged, the arch of the shaft resisting pressure, while the web and fine fibres yield without suffering. Being a bad conductor of heat, it preserves the high temperature of the bird, while it is so light as to be easily carried in flight. It is rendered almost impervious to wet by the oily fluid which most birds secrete at the base of the tail. Feathers form a considerable article of commerce, particularly those of the ostrich, heron, swan, peacock, and goose, for plumes, ornaments, filling of beds, pens, and other purposes.

**Feather-star**, one of the stalkless echinoderms belonging to the Crinoidea. A well-known type is the rosy feather-star (*Antedon rosacea*), not uncommon in British seas, and consisting of a central body or disc, from which proceed five radiating arms, each dividing into two secondary branches, so that ultimately there are ten slender rays. Each arm is furnished on both sides with lateral processes so as to assume a feather-like appearance. It is fixed when

young by a short stalk, but exists in a free condition in its adult state.

**Featherstone**, an urban district or town in the W. Riding of Yorks, England, 2 miles west by south of Pontefract; inhabitants work chiefly in the collieries. Pop. 14,839.

**Feb'rifuge** is an agent used to lessen fever. Antipyrine, quinine, and salicylic acid, are well-known examples of drugs used as febrifuges, while cold baths and cold sponging are the most effective of other methods.

**Febro'nianism**, in Roman Catholic theology, a system of doctrines antagonistic to the admitted claims of the Pope, and asserting the independence of national Churches, and the rights of bishops to unrestricted action in matters of discipline and Church government within their own dioceses. The term is derived from Justinus *Febronius*, a *nom de plume* assumed by John Nicholas von Hontheim, Archbishop of Trêves, in a work entitled *De Statu Ecclesiæ et legitima Potestate Romani Pontificis* (On the State of the Church and the Legitimate Power of the Roman Pontiff), published in 1763.

**Feb'ruary** (from the Roman *Februa*, a festival of expiation or purification), the second month in the year, having twenty-eight days, except in leap-year, when it has twenty-nine. This latter



Feather-star holding on by its grasping threads and its larvae attached by stalks

number of days it had originally among the Romans, until the Senate decreed that the seventh month should bear the name of Augustus, when a day was taken from February and added to August to make it equal to July in number of days.

**Fécamp** (fâ-kân; Lat. *Fiscanum*, derived from *Fucus Cimpus*, Fig Plain), a seaport of France, department of Seine-Inférieure, 23 miles north-east of Havre. It is one of the best ports in the Channel, and has many vessels employed in the cod, herring, and mackerel fisheries. Pop. 17,383.

**Fechter** (fesh-tär), Charles Albert, French actor and dramatist, born in 1824, died in America in 1870. His first appearance on the stage was at the Salle Molière, after which he made a short tour of Italy with a travelling French company. Returning to Paris, he appeared between 1844 and 1856 at different Parisian theatres, and in 1857 he was joint-director of the Odéon. In 1860 he came to London, and at once achieved great success as Ruy Blas and Hamlet at the Princess's Theatre, characters in which he departed widely from stage traditions. He subsequently leased the Lyceum, and afterwards the Adelphi, acting youthful and melodramatic parts with striking power. From 1870 to 1878 he lived in the United States, but his experiences as a manager in New York were not successful.

**Federal**, or **Federalist**, an appellation in America given to those politicians who wanted to strengthen the central government, in opposition to those who wished to extend the separate authority of each individual state. Hence in the Civil Wars of 1861-5 the term *Federals* was applied to the Northern party.

**Federal Government**, government by the confederation of several united states, self-governing in local matters, but subject in matters of general polity to a central authority, as, for instance, the Swiss Republic, the United States of North America, Mexico, Argentine, Brazil, The Union of South Africa, and Russia since the revolution of 1917. The degree to which such states give up their individual rights as sovereign bodies may be very different.—BIBLIOGRAPHY: Viscount Bryce, *The American Commonwealth*; Burgess, *Political Science and Comparative Constitutional Law*; Freeman, *History of Federal Government*.

**Fee**, or **Fief** (A.S. *feoh*, cattle, property), in law, primarily meant a loan of land, an estate held in trust on condition of the grantee giving personal or other service to the prince or lord who granted it. Feudal estates, however, soon came to be regarded as inalienable heritages held on various tenures; hence the term fee came to be equivalent to an estate of inheritance, that is, an interest in land which passes to heirs if the owner die intestate. The amplest estate or interest in land is that of a *fee-simple*, which is also called an absolute fee, in contradistinction to a fee limited or clogged with certain conditions. A fee-simple means the entire and absolute possession of land, with full power to alienate it

by deed, gift, or will. It is the estate out of which other lesser estates are said to be carved; such as a *fee-tail* (see *Entail*), which is limited to particular heirs, and subject to certain restrictions of use; and a *base fee*, which ceases with the existence of certain conditions.

**Fee-farm**, in law, a kind of tenure of land without homage, fealty, or other service, except that mentioned in the feoffment, which is usually the full rent.

**Feeling** is properly a synonym for sensation, or that state of consciousness which results from the application of a stimulus to some sensory nerve. It is the most universal of the senses, existing wherever there are nerves; and they are distributed over all parts of the body, though most numerous in such parts as the finger-tips and the lines where skin and mucous membrane pass into each other. This universal distribution of feeling is necessary, otherwise parts of the body might be destroyed without our knowledge. The structures which thus apprehend the impressions of contact are papillæ or cornæi elevations of the skin in which the nerves end, and which are richly supplied with blood-vessels. The term feeling is also used for a general sense of comfort or discomfort which cannot be localized, and it designates states of consciousness which are either agreeable or disagreeable. In a figurative sense the term is also applied to a mental emotion, or even to a moral conception; thus we may speak of a friendly feeling, a feeling of freedom. See *Emotion*.—BIBLIOGRAPHY: A. Bain, *The Emotions and the Will*; T. Ribot, *Psychology of the Emotions*.

**Fegatella**, a genus of Liverworts, family Marchantiales. *F. conica* is common on moist banks.

**Feijoa**, a genus of Myrtaceæ, natives of Brazil. The flowers are pollinated by birds, which feed on the juicy petals, a very unusual method.

**Faisal**, or **Faisal**, Emir, King of Irak (Mesopotamia), born in 1887, the third surviving son of Hussein, King of Hejaz. Educated at Constantinople, Faisal held several posts under the Turkish Government, but took an active part in the revolutionary movement which resulted in the deposition of Sultan Abdul Hamid. He then returned to Arabia, where he commanded the Arabs against Ibn Saud, the head of a new religious sect, who threatened his father's emirate. During the European War Hussein aided with the Allies, and Faisal organized and commanded a regular Arab army, which formed Lord Allenby's right wing, and took part in the latter's operations in Palestine. As a reward for his services an independent, or semi-independent, state was established at Damascus under Faisal, and the prince was proclaimed King of Syria in March, 1920. Serious friction, however, arose

between the French authorities and the Arabs, and hostilities broke out in July. The French, under General Gouraud, occupied Damascus, compelled the Arabs to recognize the French mandate for Syria, and deposed the new King of Syria. In August, 1921, Feisul became the first Arab king of the new state of Irak (Mesopotamia), set up by the British Government. He was crowned with great splendour at Bagdad on the 28rd of Aug., in the presence of a great gathering of his people and the representatives of the British Government. A personal message from King George V was handed to Feisul, and the British High Commissioner, Sir Percy Cox, formally announced the recognition by Great Britain of the new ruler of Irak.

**Felaniche** (fel-â-nē'châ), a town in the Island of Majorca, a very ancient place with Moorish remains. Pop. (commune), 11,400.

**Felcgyanxa** (fâ'led-yâ-zâ), a town of Hungary, 66 miles S.E. of Budapest, with large cattle-markets and an extensive trade in corn, wine, and fruit. Pop. 34,024.

**Felcu'di**, one of the Lipari Isles, off the north coast of Sicily, 10 miles west of Salina. It is about 9 miles in circuit. The soil is both fertile and well cultivated. Pop. 800.

**Felidae**, animals of the cat kind, a family of Carnivora in which the predaceous instincts reach their highest development. They are among the quadrupeds what the Falconide are among the birds. The teeth and claws are the principal instruments of the destructive energy in these animals. The incisor teeth are equal; the third tooth behind the large canine in either jaw is narrow and sharp, and these, the carnassial or sectorial teeth, work against each other like scissors in cutting flesh; the claws are sheathed and retractile. They all approach their prey stealthily, seize it with a spring, and devour it fresh. The species are numerous in Europe, Asia, Africa, and America, but none are found in Australia. The family comprehends the lion, tiger, leopard, lynx, jaguar, panther, cheetah, ounce, serval, ocelot, and cat.

**Felix**, Antonius or Claudius, procurator of Judæa and freedman of the Emperor Claudius, is described by Tacitus as unscrupulous and profligate both in his public and private conduct.

It was before this Felix that Paul's discourse (*Acts*, xxiv, 25) was spoken. He was recalled A.D. 62, and narrowly escaped condemnation at Rome, on charges which the Jews had lodged against him.

**Felix**, Marcus Minucius, a distinguished Roman lawyer, who embraced Christianity, and wrote a defence of it in a dialogue entitled *Octavius*. The period when he flourished is uncertain; but Jerome is probably right in placing him about A.D. 230.

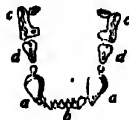
**Felixstowe**, a watering-place in England, on the Suffolk coast, 11 miles south-east of Ipswich, between the mouths of the Orwell and Deben. The steamers which ply between Ipswich and Harwich on the Orwell call at Felixstowe Pier, which is opposite Harwich. Pop. (urban district), 11,655.

**Fellah** (pl. *fellahin*), an Arabian word meaning 'peasant', and used for the labouring class in Egypt. The fellahs or *fellahin* constitute about three-fourths of the population of Egypt, and are mostly the direct descendants of the old Egyptians, although both their language and religion are now that of their Arabian conquerors. They live in rude huts by the banks of the Nile, and in past times have suffered much from over-taxation and oppressive rule at the hands of a succession of tyrants, and especially of the Turks before the British occupation of Egypt.

**Fella'tah**, **Fulbe**, or **Fulahs**, a remarkable African race of the negro type, the original locality of which is unknown, but which is now widely diffused throughout the Sudan, where they are the predominant people in the states of Futa-Toro, Futa-Jalen, Bondu, and Sokoto. Though of the negro family, they have neither the deep jet colour, the crisped hair, flat nose, nor thick lips of the negro. In person they are decidedly handsome, and mostly of a light copper colour. They are shrewd, intelligent, and brave, and are mostly Moham-medans. Their influence is continually spreading.

**Fellenberg**, Philip Emanuel von, Swiss educationalist, born in 1771, died in 1844. Having devoted himself to the social and intellectual improvement of the peasantry, he purchased the estate of Hofwyl, and established successively an institution for instructing the children of the poorer classes, a seminary for children in the higher grades of life, and a normal school. The pupils were all trained to work in the fields or at the bench, and the product of their labour was sufficient to cover the expenses of their education. Fellenberg's scheme was ultimately so successful as to attract the attention even of foreign Governments. The institutions established by him still exist in a modified form.

**Felling**, a populous locality in Durham, a little to the south-east of Newcastle, and adjoin-



Teeth of Felidæ

Skull and Teeth of the Tiger  
a, Canines or tearing teeth  
b, Incisors or cutting teeth  
c, True molars or grinding teeth  
d, Carnassial or sectorial teeth.

ing Gateshead, consisting of the combined villages of High and Low Felling, and forming an urban district. It contains chemical and other industrial works. Pop. 26,152.

**Fel'ows**, Sir Charles, traveller and antiquarian, was born in 1799 at Nottingham, died in 1860. He first explored the valley of the Xanthus in Lycia, in 1838, and discovered the remains of the cities Xanthus and Teos. Under the auspices of the trustees of the British Museum he made further explorations in 1839 and 1841, and succeeded in obtaining the marbles now in the Lycian saloon of the museum. He was knighted by the queen in 1845. His principal works are: *The Xanthian Marbles: their Acquisition and Transmission to England; Travels and Researches in Asia Minor; and Coins of Ancient Lycia before the Reign of Alexander*.

**Fellowship**, a distinction conferred by some universities, especially those of Oxford and Cambridge, which entitles the holder, called a fellow, to an annual stipend for a certain period. Fellowships in the English colleges commonly range in value from about £150 to £250 or £300 a year, and they all confer upon their holders the right to apartments in the college, and certain privileges as to commons or meals. Formerly they were usually tenable for life or till the attainment of a certain position in the Church or at the Bar, or till marriage; but six or seven years is now a common period during which they may be held, though this may be prolonged in certain circumstances. At Dublin University senior fellows hold their office for life.

**Felo de se** (Lat., 'a felon in regard to himself'), in law, a person who, being of sound mind and of the age of discretion, deliberately causes his own death. Formerly, in England, the goods of such a person were forfeited to the Crown, and his body interred in an ignominious manner; that is, unless the coroner's jury gave a verdict

of unsound mind; but these penalties have been abolished.

**Fel'ony**, in law, includes generally all crimes below treason and of greater gravity than misdemeanours. Formerly it was applied to those crimes which entailed forfeiture of lands or goods as part of the punishment.

**Felsite**, or **Felstone**, a hard, compact igneous rock of somewhat flinty appearance, composed usually of quartz and orthoclase felspar intimately mixed, but sometimes of less highly siliceous minerals.

**Fel'spar**, or **Feldspar**, a very important group of mineral silicates of aluminium, with potassium, sodium, or calcium, ranging from orthoclase, the potassium species, with 64·7 per cent of silica, to anorthite, the calcium species, with only 43·3. Albite, the sodium felspar, has 68·8 per cent of silica, and the species between this and anorthite are regarded as mixtures of albite and anorthite molecules. These molecules probably do not exist as such within the crystals; but the various characters of the species graduate into one another in agreement with the chemical constitution, so that the felspars form an admirable example of the relation of chemical composition, specific gravity, and crystalline and optical features. At the same time orthoclase and microcline are both potassium felspars; yet the former crystallizes in the monoclinic, and the latter in the triclinic system. All the sodium, sodium-calcium, and calcium species are triclinic, except the rare monoclinic sodium felspar barbicrite. The forms throughout the felspar series are closely similar, and the hardness is uniform, being just below that of quartz, and about that of a steel file. Felspar is one of the principal constituents of almost all igneous rocks, such as granite, diorite, and basalt. The alkali species yield kaolin by alteration, and are thus the source of china-clay.





